November

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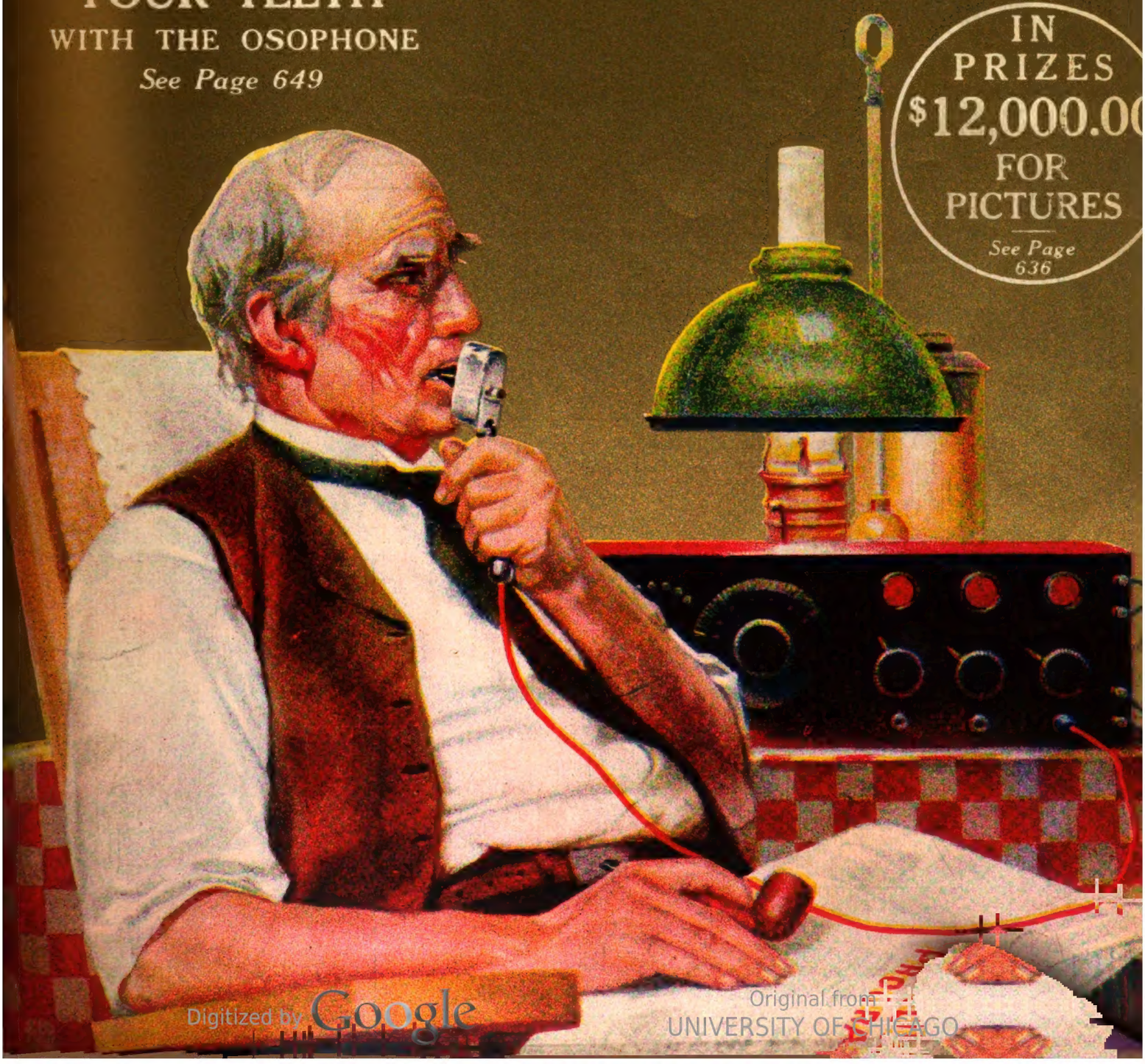

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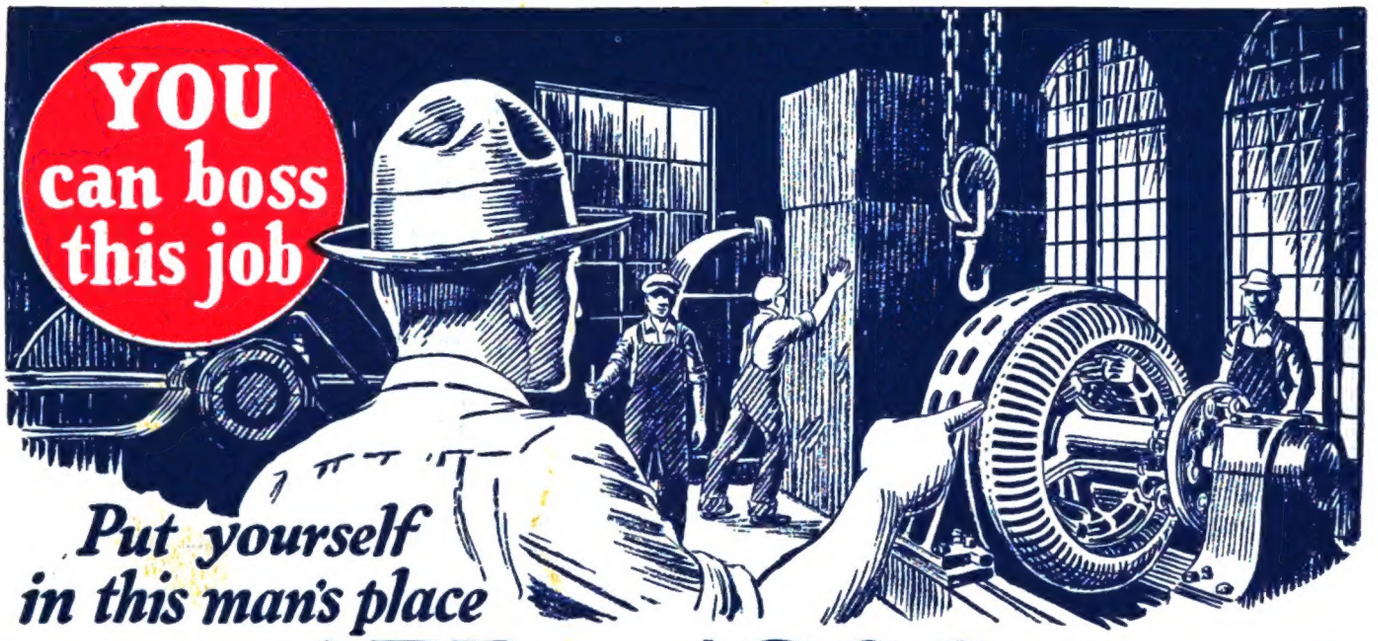


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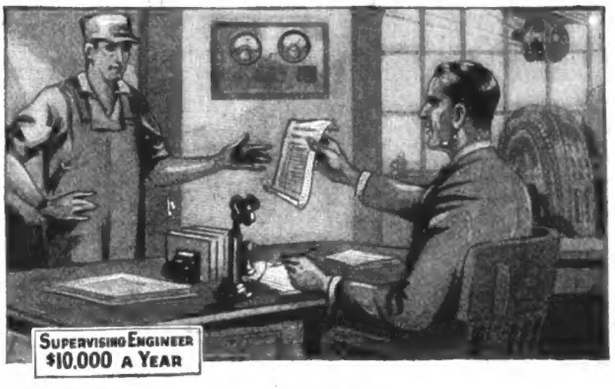


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# Science and Invention

FORMERLY

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# How much money do inventors make—or lose?


## Raymond Francis Yates

***American Society of Mechanical Engineers***
***American Institute of Electrical Engineers***
***Institute of Radio Engineers***
***American Physical Society***

OVER 70,000 patents were allowed in this country last year, but only about 3500 had any real commercial value. Most of the 3500 practical inventions were developed by professional inventors, while most of the impractical inventions were the work of "free-lance" inventors—men and women who suddenly decided that they had an idea for an invention, and immediately set about to perfect it.

Of course there must be some reason why the trained inventor is so uniformly successful in his inventions, while the untrained inventor so often fails. Probably the greatest cause is that most people believe invention to be a "hit or miss" proposition—an out-and-out gamble. That is why so many would-be inventors waste years of effort, eat deep into their savings to work on inventions which can never bring them a penny, why still others who do produce worthwhile inventions lose their rights in them or receive only a pittance for their hard work.

### What Invention Is

It doesn't require much thought to see that invention cannot be a matter of pure luck. Neither is it, as some people seem to think, something which only a genius can do. As a matter of cold fact, invention—successful invention—is nothing more or less than the careful, methodical use of certain fundamental facts, which anybody can learn easily.

It may seem strange to you that Invention can be learned exactly as you learned reading, writing and arithmetic. Yet proof of this is easy. You will admit that if, as I have said, invention can be studied like any other profession—like mechanics, law, book-keeping, medicine — then those who do learn it should be able to produce many different kinds of Inventions.

Of course you are familiar with Edison's inventions. Here are additional examples of less known inventors. Christopher N. Spencer first invented the breech-loading repeating rifle, which he followed by inventing the thread-spooler, the automatic turret - lathe, the automatic screw-machine, the "pump action" repeating rifle. He was also part-inventor of the drop hammer. B. T. Babbitt, of soap fame, invented the process of wrapping and pressing laundry soap in cakes, besides inventing the first commercial baking powder, floating white soap, commercial chemicals, and several railroad devices. Henry Gaisman, inventor of the Auto-Strop Safety Razor, is also the inventor of the Autographic Kodak which he sold outright for $300,000.

### How Inventions Are Made

That, you will agree, answers the question: "How much money do inventors make—or lose." If the inventor *knows* what he is doing, if he has studied the principles of invention and uses them, he is bound to make money. But if the would-be inventor merely takes a chance without any real thought of what he is doing or how to do it, the chances are a hundred to one that he won't make a cent.

However, Inventive Science is easy to learn, because everybody—every man, every woman—is born with the inventive instinct. You will understand better what I mean when you realize that an invention is only a device which "fixes" or improves something.

All inventions are made just this way. First some need is seen and recognized—new amusements, better light, better power, cheaper transportation, better automobile accessories—any one of a thousand needs which are impressed upon you every day. The next step is to find some idea which will answer the need—either through some mechanical, physical or chemical law. Finally comes the actual work of invention where you develop your ideas along the simple, exact lines of Inventive Science, and then protect and market your invention for your greatest profit.

### More Inventions Needed Now

I said before that an invention is merely a device for satisfying some need, or improving some other device so that it will work better, faster or cheaper. And, because the world today needs vastly more things that it needed 500 years ago, the demand for inventions is so much more urgent.

It isn't necessary that you must invent something like the steam-engine to make money. Little inventions, such as the crimped hair-pin, the metal bottle-cap, the rubber tip on the pencil have all brought their inventors great fortunes. Gillette, it is reported, has received $2,500,000 *a year* for his invention of the Gillette Safety Razor.

To show you what a little invention can bring you in real money, let me tell you the story of two very simple inventions. The man who invented the Kiddie-Kar (which he produced in his search for a new cheap amusement for his children) is now worth, it is said, more than $5,000,000. Success Magazine, a few months ago, told the story of a woman who, bothered by a shaky table, fixed up a little wedge - shaped piece of wood. Out of that simple idea she developed an invention which has brought her amazing success.

It doesn't matter what work you do, what your education has been or where you live—*you* can learn to develop successful inventions. Like the man who invented the Kiddie-Kar you may win a fortune through some device to amuse your children. Even a new kind of kitchen knife to make your wife's work easier can make big money for you. Your daily occupation in the office, in the factory, on the farm; your experiences at home or traveling gives you thousands of ideas every day which can be completed as wonderful inventions. And remember that the world is waiting for more inventions now and will pay big money for even the simplest idea.

### You Can Learn Invention at Home

Hitherto the average person has had little chance of success in invention, because he lacked the necessary instruction in the few essential points of Inventive Science. Now, however, everybody who wants to invent can take advantage of a remarkable new course, devised by fifteen of America's inventors (I am one of them), which shows the right way to practical, successful invention. For the first time, the laws of invention used by Edison, Marconi, Sperry, De Forest and every other great inventor are explained in such simple, easy-to-learn language that everybody can learn to use them.

No longer is it necessary to spend years in useless effort learning the simple secrets which make invention easy. No longer need you waste time on inventions which will never bring you a penny. No longer need you be the victim of unscrupulous persons because you don't know how to protect your rights.

In a fascinating, easy course of 25 "common sense" lessons you are told how to look for ideas for practical money-making inventions, and where they are most likely to be found. You are informed how to develop these ideas quickly and at the least expense. You learn how successful inventors work, the materials they use, where and how they collect their information, the short-cuts they use.

Most important of all you learn how to keep records of your invention to prove priority of origin, how to get patents in the United States and in foreign countries, how to select and deal with patent attorneys, how to protect your patent rights. Finally you are told about that part of Inventive Science which finally makes for success or failure. You are given hints as to the best way to dispose of your patents—how to sell it outright or on royalty, how to organize a company or form a partnership to properly sell your invention so you will get greatest protection and make greatest profits.

All these facts and hundreds of others have been learned by other inventors only after paying a terrific price in long years of unceasing labor, of discouragment and of failure. Now you can get them, without effort, without discouragment or failure, in just a few minutes each day through this absorbingly interesting home-study course.

## EDISON SAYS

### Invention should be taught as a science

Could you ask the advice of any greater authority than Thomas A. Edison. Is there any other man in the world to whom you would rather go for advice than this master of invention? Listen to what he says: "INVENTION IS A SCIENCE AND SHOULD BE TAUGHT AS A PROFESSION."

And now, for the first time, you can actually learn invention as a profession. You can profit by Edison's advice. The Bureau of Inventive Science, founded by Raymond Francis Yates, together with fourteen other great inventors, now offers you the first course in practical invention ever devised for home study.

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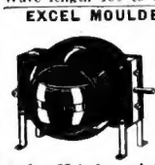

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| 750 | 5000-12000 | E313 | 1.43 | E333 | 1.93 |
| 1000 | 7900-15000 | E314 | 1.70 | E334 | 2.25 |
| 1250 | 9750-19500 | E315 | 1.92 | E335 | 2.45 |
| 1500 | 14500-26500 | E316 | 2.18 | E336 | 2.60 |

### INDUCTANCE COIL MOUNTINGS

**E340**—3 Coil. Ea. .....$3.40

**E341**—2 Coil. Ea. ..... 2.75

Sturdy, rigid durable construction. Made of polished black bakelite. Mount on front of panel.

### BACK OF PANEL MOUNTING

Mounts back of panel, with knobs or dials on front of panel. Helps make a neat efficient set.

**E342**—3 Coil Back of Panel Mounting .....$4.45

### BRASS ROD

Supplied only in 8 inch lengths.

**E961** Threaded 6-32, per 8 in. length 6c
**E963** Threaded 8-32, per 8 in. length 8c
**E965** Solid 3-16 in., per 8 in. length 6c
**E967** Solid ¼ in., per 8 in. length... 9c

### OUR SPECIAL VARIOMETER AND VARIOCOUPLER

Build into your set reliable instruments. You can depend on this variometer and variocoupler to give you the best results in any circuit working from 180 to 650 meters. In design and construction they are the best. Only the highest grade materials are used. The prices quoted save you 30 to 40 per cent. Why pay more?

**E418** Variocoupler. Each.....$2.45

The most efficient type of coupler, insures better tuning and louder signals. Primary and secondary wound on natural uncolored genuine bakelite tubes. Handsome green silk windings. Primary tapped for fine tuning. Can be panel or table mounted. ¼ inch shaft.

**E410** Variometer. Each.....$2.10

Perfect in design and construction. Accurate wood forms thoroughly seasoned. Correct inductive ratios. Solid baked windings. Plenty of large sized wire insures highest efficiency. A durable high grade instrument that will give you lasting service. ¼ inch shaft.

### COIL MOUNTING PLUGS

Made of genuine bakelite.

**E344** Plug for mounting "honeycomb" inductance coils .....39c

**E345** Stationary plug to fasten mounted coil stationary to panel .....42c

**E346** Movable plug to fasten mounted coil to panel so it can be rotated.....89c

**E343** Fibre strip to hold coils for mounting. Two foot piece .....15c

### MAGNET WIRE

Insulated copper wire. Best quality even drawn wire, one piece to a spool. Prices quoted are for 8 oz. spools unless otherwise stated.

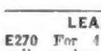
| DoubleCotton Covered | | Enameled Insulation | | Green Silk Covered | |
|---|---|---|---|---|---|
| Number E990 | | Number E992 | | Number E991 | |
| Gauge | Price | Gauge | Price | Gauge | Price |
| 18 | .43c | 20 | .39c | 20 | $0.78 |
| 20 | .55c | 22 | .50c | 22 | .95 |
| 22 | .70c | 24 | .55c | 24 | 1.10 |
| 24 | .80c | 26 | .60c | 26 | 1.38 |
| 26 | .90c | 30 | .65c | 30 (4 oz.) | 1.25 |
| 28 | $1.05 | 32 | .70c | 32 (4 oz.) | 1.65 |
| 30 | 1.45 | 36 | .90c | 36 (4 oz.) | 2.20 |

### ANTENNA INSULATORS

**E260**

**E260** Size 1x3¼. Composition, metal eyelets. Two for .....17c

**E264** Size 1½x4. Two dium size aerials. Two for .....69c



**E264-6**

**E266** Size 1½x10½. For large aerials. Two for..$1.28

**E263** Ribbed Porcelain insulator, 2¼ in. long. Ea. 6c Dozen .....55c

### LEAD-IN INSULATORS

**E270** For 4 inch walls or less.....42c

**E271** For 9 inch walls or less.....69c

The only practical lead in insulator for aerial wires. Small, neat, effective, durable. Fits ⅝ inch hole. Securely locked by two adjustable nuts.

### OUTDOOR LIGHTNING ARRESTER

**E980** Price .....$1.55

Protect your instruments with this lightning arrester. Weatherproof porcelain case. Air gap type. Permanent. Durable. Underwriters approved.

### HIGH-GRADE LIGHTNING ARRESTER

**E981** Each .....79c

A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved.

### REINARTZ INDUCTANCE

**E296** Each.....$1.15

Made of green silk covered wire, spider-web wound to produce greatest efficiency and lowest losses. 21 taps so arranged that crossing is avoided. Two fibre strips and wooden rod furnished permit various styles of mounting. With this coil a high grade set can be built at a low cost. Directions included

### SPIDER WEB COILS

**E290**— 25 turn. Each.....39c
**E291**— 35 turn. Each.....42c
**E292**— 50 turn. Each.....47c
**E293**— 75 turn. Each.....54c
**E294**—100 turn. Each.....59c

A new popular type of inductance of highest efficiency. Lowest distributed capacity and lowest high frequency resistance. Firm green silk windings with fibre mounting strips.

### ULTRA AUDION COIL

**E296** Each .....85c

Spider web wound of green silk covered wire. Four taps. Makes up a set that produces wonderful results. Fibre strips and wooden rod for mounting included. Directions furnished.

### STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.

**E248**—100 ft. coil .....58c
**E249**—500 ft. coil .....$2.75

### SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments.

Solid Bare Copper Wire, size 14.

**E240**—100 ft. coil .....46c
**E242**—500 ft. coil .....$2.15

Solid Bare Copper Wire, size 12.

**E244**—100 ft. coil .....67c
**E245**—500 ft. coil .....$3.05

### TINNED COPPER "BUS BAR" WIRE

Size 14 tinned copper wire. For wiring sets. Best size for neat job and easy soldering.

**E957** Round. Ten feet for.....12c
**E958** Square. Ten feet for.....14c

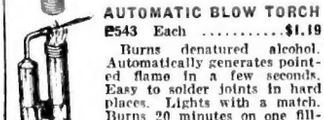
### SPAGHETTI

For covering connecting wires in sets. For size 12 and 14 wires.

**E955** Finest quality braided and saturated with best baked lustrous transparent insulating varnish, 3 feet for.....19c

**E956** Best quality braid and covered with black insulating compound. 3 feet for..9c

### RADIO SOLDERING IRON



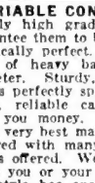
**E540** Each .....$1.50

Soldered connections in radio sets produce better results. This guaranteed iron is exactly right for radio work. A neat solid connection quickly and easily made. Operates on any lighting socket 100 to 120 volts. 6 ft. cord with attaching plug. Length 13 inches. Heats quickly, will not overheat.

Heavier irons for general repair or manufacturing work. Wonderful values at our prices.

**E541** Medium size .....$3.48
**E542** Larger size ..... 4.25

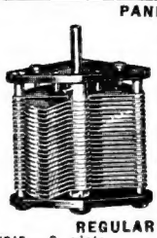
### AUTOMATIC BLOW TORCH



**E543** Each .....$1.19

Burns denatured alcohol. Automatically generates pointed flame in a few seconds. Easy to solder joints in hard places. Lights with a match. Burns 20 minutes on one filling. 5½ inches high. ⅞ inch diameter cylinders. Works fine with Tinol listed above.

### PANEL MOUNTING VARIABLE CONDENSERS



These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even, reliable capacity. Our low prices save you money. These condensers are of the very best make and are not to be compared with many inferior, cheap condensers offered. We guarantee them to please you or your money back. The vernier style has one separately controlled plate which permits of the finest tuning.

**REGULAR STYLE**

**E815**— 3 plate .....65c
**E816**— 5 plate .....97c
**E814**—11 plate .00025 mfd. .....$1.28
**E813**—21 plate .0005 mfd. ..... 1.35
**E812**—13 plate .001 mfd. ..... 1.58

**VERNIER STYLE**

**Including Dial and Knobs**

**E825**—11 plate .00025 mfd. .....$2.45
**E824**—26 plate .0005 mfd. ..... 2.75
**E826**—16 plate .001 mfd. ..... 3.15

### SUPER BLOW TORCH

**E544** Each .....39c

Burns denatured alcohol. Vest pocket size. Blowing on tube produces a hot pointed flame. Lights with a match. Works fast. Burns 10 minutes on one filling. Easy to solder joints in hard places. 3 in. high. ⅞ in. cylinder. Long rubber tube. Produces fine joints with Tinol listed above.

### ENCLOSED VARIABLE CONDENSERS

One of the best made condensers. Rigid, accurately spaced aluminum plates. Formica ends. Engraved scale. Knob and pointer. Clear transparent case.

**E806** 43 plate .001 Mfd. .....$2.89

**E808** 21 plate .0005 Mfd. .....$2.45

### OUR SPECIAL AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

**E550** Each .....$2.15

The result of years of research work and experienced engineering. In quality of tone and volume of sound, the things a transformer is built for, we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. 5 to 1 Ratio. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect. Not to be compared with articles built for price only.

### OUR SPECIAL SHIELDED TRANSFORMER

**E551**—3½ to 1 Ratio. Each .....$2.55

**E552**—6 to 1 Ratio. Each .....$2.75

The same high grade style of transformer as above enclosed in a metal case which completely shields it from any outside magnetic influences. Very attractive appearance and sturdy construction. Free from howling and local disturbances.

### THORDARSON AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

**E232** Ratio 3½ to 1. $3.40

**E233** Ratio 6 to 1. 3.80

Recognized by leading radio engineers as the best balanced and most efficient transformer. Correct characteristics for any standard tube. Wonderful results without distortion on one, two or three steps. Plainly marked binding post connections on bakelite panel.

### OTHER STANDARD BRANDS AUDIO FREQUENCY TRANSFORMERS

Fresh, clean stock in original containers.

| | | |
|---|---|---|
| E553 | Acme. Each | $4.45 |
| E554 | Coto. Each | 4.45 |
| E555 | Federal. Each | 4.45 |
| E712 | Radio Corp. Each | 6.40 |
| E234 | All American 10 to 1 Shielded | 4.15 |
| E239 | All American 5 to 1 Shielded | 4.10 |
| E236 | All American 3 to 1 Shielded | 3.95 |

### RADIO FREQUENCY AMPLIFYING TRANSFORMER

**E560** For 201A or 301A Tubes .....$1.70

**E561** For 199 or 11 or 12 Tubes .....$1.70

Due to its special design this transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. While low in price we believe it equal or superior to higher priced transformers. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters. Try it. If you are not satisfied return it and get your money back.

### OTHER STANDARD BRANDS RADIO FREQUENCY TRANSFORMERS

| | | |
|---|---|---|
| E568 | Our special—as good as any of them | $ .48 |
| E562 | Dubilier. Each | 4.45 |
| E563 | Coto. Each | 4.45 |
| E564 | Rasla. Each | 4.45 |
| E565 | Acme. First stage. Each | 4.45 |
| E566 | Acme. Second stage. Each | 4.45 |
| E567 | Acme. Third stage. Each | 4.45 |
| E714 | Radio Corp. Each | 5.95 |
| E995 | All-American. Each | 3.95 |
| E575 | Erla. First stage. Each | 3.55 |
| E576 | Erla. Second stage. Each | 3.55 |
| E577 | Erla. Third stage. Each | 3.55 |
| E578 | Erla. Reflex. Each | 4.45 |

### NEUTRODYNE TRANSFORMERS

**E571** Per set of three.....$1.95

An air core transformer for use in neutrodyne method of reception. Can also be used for tuned radio frequency or as a fixed coupler with condenser across secondary. Proper design for results and efficiency. Green silk windings on bakelite tubes with adjustable mounting brackets to fit most any condenser.

### NEUTRALIZING CONDENSERS

**E572** Per set of two.....40c

Simple, inexpensive, effective precision type. Micrometer adjustment is attainable. Easily mounted in circuit.

**SPECIAL**

**E573** Neutrodyne Jack. Each.....89c

**THE BARAW[illegible]** Chicago's Original Radio Supply House Beware of Imitators **102 South Canal St., Chicago, Ill.**

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# WITH BARAWIK STANDARD RADIO GOODS

BUILD YOUR SET WITH BARAWIK STANDARD RADIO GOODS

### VACUUM TUBES

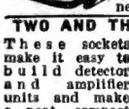
Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect. We will ship brand in stock unless you specify otherwise.

E105 Detector, UV200 C300 Each .....$4.30
E112 Amplifier, UV201A C301A ..... 5.75
E118 5 Watt Transmitter.. 7.70
E102 UV199 C299. Each..... 5.75
E107 WD11 C11. Each..... 5.75
E101 WD12 C12. Each..... 5.75
E104 UV199 Adapter fits 199 tube to standard socket ..... .42
E108 WD11 Socket. Each..... .35
E109 WD11 Adapter. Each..... .48

### STANDARD TUBE SOCKET

E140 Each .....39c
Moulded of genuine red brown bakelite. Binding post connections. For table or panel mounting. Neat and strong.

### METAL TUBE SOCKET



E146 Each .....42c
A strong durable socket for panel or table mounting. Metal tube and base. Plainly marked binding post connections well insulated.

### TWO AND THREE GANG SOCKETS

These sockets make it easy to build detector and amplifier units and make a neat, compact workmanlike job. Perfectly made of high grade materials. Quickly mounted on panel or base.
E147 Two-gang socket ..... 95c
E149 Three-gang socket .....$1.30

### 199 SOCKET

E145 Each .....49c
Moulded of high insulating material. Sponge rubber base prevents ringing in tube. Plainly marked binding post connections. Neat and compact.

### FILAMENT CONTROL RHEOSTATS

E132 6 ohm. Each.....45c
E129 20 ohm. Each....52c
E131 30 ohm. Each....59c
E135 6 ohm Vernier..95c
Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2⅛ in. Tapered polished black knob 1½" diam.
**Potentiometers.** Match above rheostats. Same high grade construction.
E151 200 ohm. Each.....79c
E152 400 ohm. Each.....79c

### SUPERIOR RHEOSTATS

E153— 6 ohm. Each.....69c
E154—20 ohm. Each.....76c
E155—30 ohm. Each.....83c
The finest rheostat. Smooth, even action. Best design, best workmanship. Supplied with attractive dial and knob. A rheostat for high grade sets.
**Potentiometers** to match above rheostats with dial and knob.
E156—375 ohm .....98c

### QUICK ACTING RHEOSTAT

E124— 6 ohm. Ea....79c
E125—15 ohm. Ea....88c
E126—30 ohm. Ea....99c
Vernier adjustment at every degree of resistance. Pushing knob in turns off the filament.

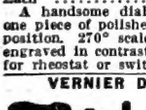
### THREE INCH DIAL

E923 For 3-16 inch shaft. Each .....19c
E924 For ¼ inch shaft. Each .....19c
A handsome neat looking dial moulded in one piece of polished black composition. 180° scale marked 0 to 100 finely engraved in contrasting white enamel. Diameter 3 inches.

### TWO INCH DIAL

E921 For 3-16 inch shaft. Each .....16c
E922 For ¼ inch shaft. Each .....16c
A handsome dial moulded in one piece of polished black composition. 270° scale marked 0 to 100 finely engraved in contrasting white enamel. Fine for rheostat or switch control. Diam. 2 in.

### VERNIER DIAL ADJUSTER



E941 Each .....19c
Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.

### DETECTOR CRYSTAL CAREFULLY TESTED

E736 Galena, Arlington tested, piece 19c
E738 Silicon, Arlington tested, piece 19c
E735 Tested, Galena, Mounted, piece 9c
E737 Tested, Silicon, per piece..... 9c
E739 Genuine million point crystal. Ea. 29c

### "B" BATTERY METER

E189 Each .....98c
Reads 0 to 50 volts. Accurately tells you the exact condition of your B Battery. Convenient watch size. Polished nickel case with wire lead.

## WE PAY TRANSPORTATION CHARGES EAST OF THE ROCKIES

**PRESERVE THESE PAGES — ORDER FROM THEM AND SAVE MONEY**
**FAST SERVICE — TRY US AND BE CONVINCED**
**THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR**

**OUR GUARANTEE PROTECTS YOU—We handle only the best goods, carefully tested and checked by expert radio engineers. You are assured of getting guaranteed apparatus that will give superior results. And while our goods are best, our prices are lowest. Our goods equal or surpass the claims we make for them. We do not attempt to deceive or mislead. Our reputation for fair dealing is our most valued asset.**

**HOW TO ORDER—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.**

### GREWOL CRYSTAL DETECTOR

E742 Each .....$1.69

### BAKELITE DIALS

E931—2 in. Diam. for 3-16 in. shaft. Each 32c
E932—2 in. Diam. for ¼ in. shaft. Each...32c
E933—3 in. Diam. for 3-16 in. shaft. Each..33c
E934—3 in. Diam. for ¼ in. shaft. Each...33c
E935—4 in. Diam. for ¼ in. shaft. Ea.40c
Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Sizes match perfectly.

### ENCLOSED DETECTOR

One of the finest crystal detectors on the market, supersensitive galena crystal enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish.
E730 Each .....89c

### GALENA DETECTOR

Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish. An unequaled value.
E732 Each .....59c

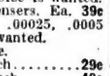
### SUPERIOR VARIABLE GRID RESISTANCE

E167 Each .....80c
E168 With .00025 Condenser .....95c
Eliminates hissing, clarifies signals. Capacity smoothly varied from 0 to 6 megohms by half turn of knob. Easily mounted on any panel.
E171 Freshman panel mounting variable grid leak with .00025 condenser. Each 69c
E172 Durham variable grid leak with mounting. Each .....89c
D173 CRL Variable grid leak. Each $1.19

### TUBULAR GRID LEAKS AND CONDENSERS

Very convenient. Permit of quick change of leaks or condensers of varying capacity. Cut shows leak mounted. Leaks and condensers have same appearance. Each part priced separately.
E849 Grid Leaks. Each.....18c
**Resistances**—½, 1, 1½, 2, 3, 5, 7, and 10 megohms. Specify which size is wanted.
E831 Grid and Plate Condensers. Ea. 39c
Capacities—.00025, .0001, .00025, .0005 mfd. Specify which size is wanted.
**Mountings.** Bakelite base.
E840 Single mounting. Each.....29c
E842 Double mounting. Each.....49c
E844 Triple mounting. Each.....69c

### VARIABLE GRID LEAKS

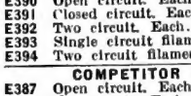


E160 Standard style...15c
E161 De Luxe style with extra heavy screw top finely finished .....32c
Pencil mark type for panel mounting. Resistance may be varied exactly as needed.

### GRID CONDENSERS

E162 Well insulated. Paper covering. Each .....8c
E163 Highest grade. Mica insulated. Polished nickel case. Each .....23c
Fit over posts of above leaks. The combination makes an efficient unit. Cap. .00025 mfd.

### SUPERIOR RADIO JACKS



Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.
E390 Open circuit. Each.....38c
E391 Closed circuit. Each.....46c
E392 Two circuit. Each.....55c
E393 Single circuit filament cont.....59c
E394 Two circuit filament cont.....76c

### COMPETITOR JACKS

E387 Open circuit. Each.....27c
E388 Two circuit. Each.....35c
Well made, durable, smooth working, nickel finished frame. Well insulated.

### SUPERIOR RADIO PLUGS

E395 With set screws for fastening cord. Each ...35c
E397 Two-way — takes two pair any style cords. Each.....59c
Highest grade plugs. Fit any standard jacks. Polished round barrels.

### SWITCH CONTACT POINTS

Brass polished nickel finish. All have ⅝ in. long size 6-32 screws and two nuts. All prices the same.
Dozen 18c Hundred $1.05
Order by Article Number.
E360 Head, ¼" diam.; ¼" high
E362 Head, 3-16" diam.; ¼" high
E363 Head, 3-16" diam.; 1-10" high

**Solder Lugs to Fit Contact Points**
Also for connecting wires to binding posts, etc.
E365 Dozen 8c Hundred 30c

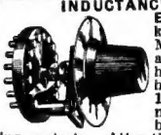
### SWITCH LEVER STOP

Brass polished nickel finish.
E386 Dozen 18c Hundred $1.05

### SWITCH LEVERS

Very neat polished black composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch.
E381 1¼ in. Radius. Ea. 15c

### INDUCTANCE SWITCH



E385 Price including knob and dial..$1.29
Mounts switch points and contact lever behind panel. Only one hole needed to mount. 15 switch points, any number of which may be used. Smooth wiping contacts. Attractive tapered knob.

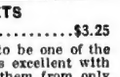
### SUPERIOR INDUCTANCE SWITCH

E384 Each .....79c
Quickly and securely mounted by drilling one hole. Only knob and pointer show in front of panel. Connections can be soldered before fastening switch, making assembly much easier. Metal parts nickeled. Bakelite knob and supporting base.

### HYDROMETER

E190 Each .....48c
Accurately tells you the condition of your storage battery. Helps you keep your battery in better condition.

### BATTERY CLIPS



E198 Two for .....28c
Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.

### BARAWIK QUALITY HEADSETS

E770 Per Set, 2000 ohms.....$3.25

These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. Skilled workmen make them from only the best selected materials. The receiver cases are fine polished finish with polished black ear pieces. Fabric covered head band comfortably and quickly fitted to the head. Supplied with 5-foot cord. These sets were designed to sell for much higher prices than we ask, and at our price are a wonderful bargain. We guarantee that you will be pleased with them and agree that they are the best value by far yet offered. If they don't suit you we will cheerfully return your money.

### STANDARD BRAND HEADSETS

E754 Baldwin Type C with universal jack plug $11.75
E756 Red-Head, 3000 ohm ..... 5.78
E768 Brandes, 2000 ohm ..... 5.35
E769 Brandes, 3000 ohm ..... 6.95
E751 Murdock 56, 2000 ohm .....$3.59
E752 Murdock 56, 3000 ohm ..... 3.95
E764 Frost, 2000 ohm 3.59
E766 Frost, 3000 ohm 4.45
E758 Western Electric 9.50

### BINDING POSTS

Brass, polished nickel finish. Washer and 6-32 in. screw extending ⅝ in.
E370 Large size—barrel and knob ¾" long. Dozen .....85c
E372 Smaller size — barrel and knob 9-16" long. Dozen.....70c

E370-2-4 E376-8

E374 Large size with composition knob. Dozen .....45c
E376 Large size with hole for phone tip or wire. Dozen.....80c
E378 Small size with hole for phone tip or wire. Dozen.....35c

### PLATE CIRCUIT "B" BATTERIES

You can make real savings on these batteries. Don't pay more. We guarantee them to equal any on the market regardless of price. Absolutely uniform. Extra long life.
E180 Signal Corps type, small size. 15 cells, 22½ volts. Each .....$1.10
E182 Large size, 5 taps 16½, 18, 19½, 21 and 22 volts. Each.....$1.59
E184 Variable Large Navy size, 16½x4x3 inches 5 taps, giving range from 16½ to 22½ volts in 1½ volt steps. Each...$1.95
E188 Combination Tapped 45 volts, 30 cell, 13x4x3 battery. Tapped to give 45, 22½, 21, 19½, 18 and 16½ volts. Handles both detector and amplifier tubes. Ea. $3.65

### STORAGE "A" BATTERY

A very high grade battery made especially for radio service. Guaranteed for three years. Properly cared for will give many more years of service for filament lighting. Made of best new materials. Full capacity. The best battery buy on the market. Try one of these batteries on your set for 10 days. If at the end of that time you are not fully satisfied with the battery return it and we will refund the purchase price.
E194 6 volt, 40 ampere size. Each $10.75
E196 6 volt, 80 ampere size. Each 13.25

### HOMECHARGER BATTERY CHARGING RECTIFIER

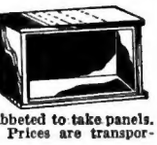
Charge your battery at home over night for a few cents. Simply connect to any 110 volt 60 cycle light socket, turn on current and rectifier does the rest automatically. Will work for years without attention. Simple connections Gives a tapering charge which batteries should have. You can make it pay a profit charging your friends' auto batteries. Long connecting cords with pair of battery clips.
E201 For 6 volt battery.....$12.95
E203 For 12 volt battery..... 12.95

### RADIO "BAKELITE" PANELS

Notice our very low prices on this fine quality material. Others ask as much for hard rubber panels which are worth much less. We supply genuine Bakelite, Condensite Celeron or Formica, all of which are materials with practically identical mechanical, chemical and electrical properties. Machines well without chipping. Won't warp. Waterproof. Highest mechanical and dielectric strength. Attractive natural polished black finish which can be sanded and oiled.

| Panel Size Inches | ⅛" thick Art. No. | Price | 3-16" thick Art. No. | Price | ¼" thick Art. No. | Price |
|---|---|---|---|---|---|---|
| 6x 7 | E450 | $0.57 | E460 | $0.86 | E470 | $1.15 |
| 6x10½ | E451 | .86 | E461 | 1.27 | E470 | 1.73 |
| 7x14 | E458 | 1.38 | E468 | 2.07 | E478 | 2.76 |
| 7x18 | E453 | 1.78 | E463 | 2.65 | E473 | 3.56 |
| 7x21 | E457 | 2.05 | E467 | 3.05 | E477 | 5.10 |
| 7x24 | E459 | 2.42 | E469 | 3.56 | | |
| 9x14 | E454 | 1.85 | E464 | 2.65 | E474 | 3.56 |
| 12x14 | E455 | 2.42 | E465 | 3.56 | E475 | 4.78 |
| 12x21 | E456 | 3.62 | E466 | 5.35 | E476 | 7.13 |

### CABINETS



Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Prices are transportation paid.

| Panel Size | Inside Dimensions High | Wide | Deep | Art. No. | Price Each |
|---|---|---|---|---|---|
| 6x 7" | 5⅛" | 6½" | 7" | E420 | $2.15 |
| 6x10½" | 5⅛" | 10 " | 7" | E422 | 2.65 |
| 7x14" | 6⅛" | 13¼" | 7" | E423 | 3.20 |
| 7x18" | 6⅛" | 17¼" | 7" | E426 | 3.45 |
| 7x21" | 6⅛" | 20½" | 7" | E425 | 3.85 |
| 7x24" | 6⅛" | 23½" | 7" | E429 | 4.65 |
| 9x14" | 8⅛" | 13½" | 10" | E428 | 3.55 |
| 12x14" | 11⅛" | 13½" | 10" | E430 | 4.65 |
| 12x21" | 11⅛" | 20½" | 10" | E432 | 5.45 |

## THE BARAWIK CO. Chicago's Original Radio Supply House Beware of Imitators 102 South Canal St., Chicago, Ill.

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Volume XI
Whole No. 127

# Science and Invention

H. GERNSBACK, EDITOR AND PUBLISHER
H. WINFIELD SECOR, ASSOCIATE EDITOR
T. O'CONOR SLOANE, Ph.D., ASSOCIATE EDITOR
Editorial and General Offices, - - - 53 Park Place, New York

NOVEMBER
1923
No. 7

***"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact"--HUXLEY***

# Are We Intelligent?

**By H. GERNSBACK**

THE members of the human race, who think themselves preeminent on this planet, have long since come to the conclusion that the human animal is a superior living being, quite distinct and far above all other living creatures. This conclusion, so general that it seems to be inborn, has been handed down through the ages, mainly for the reason that we imagine all of our acts and thinking are based upon intelligence. For instance, we say that a dog or a cat cannot think and reason. They are, therefore, not endowed with intelligence. Or perhaps to put it in a better way, we think that an animal or insect cannot reason the way we do. Consequently, in our arrogance, we maintain that they are inferior to us.

**I BELIEVE**

**¶ THAT a patent in the shop is worth three in the patent office.**

We have subdued nearly all of the larger animals to our will and have either turned them into domestic servants or else have nearly exterminated them.

But are these proofs that we are intelligent? Intelligence among other things should call for a thorough understanding of every subject. Every human being, however, will admit that we comprehended practically nothing. We cannot fathom the simplest acts of the animals that we class beneath us. Our mentality is such that we cannot even interpret the simplest "thoughts" or instincts of a dog. But when we come to such creatures as insects, which have existed on this planet hundreds and thousands of years longer than we have, we are forced to admit the fact that certain species are far more intelligent than we are.

**I BELIEVE**

**¶ THAT invention and science are directly responsible for nearly all of our great industries today.**

Take the ants for instance! With them the welfare of the nation is preeminent. Everything is subordinated to this thought; call it instinct if you wish. The ant does not require newspapers to get the news, as all news is transmitted instantaneously by a sort of "radio" system that reaches every ant in a fraction of a second. Similar cases prevail with the bees, as well as many other highly civilized insects.

Only because our senses are as poor as they are, do we find it necessary to use such artifices, as the printed page, railroads, the telephone, the telegraph, and nearly every other artifice that you can think of. You can imagine, perhaps, a million years hence, a central "radio" station broadcasting the news of the day, not in the spoken word, but in thought waves, so that everyone on the planet will get the news instantaneously. This does not mean intelligence only, but pictures and everything. In other words, intelligence will be transmitted by thought waves which will bring into our minds the exact news or information transmitted. Naturally, if we ever reach this stage, the telephone and telegraph will be unnecessary because we will be able to transmit our thoughts direct to our friends in a less cumbersome way than we do today. We need our railroads and transportation systems in the present era, simply because we have not learned to live as does the ant, for instance. We still must roam the planet in order to find the food and clothing we need. We may be sure that 100,000 years hence, such a situation will not prevail. We will be able to convert everything on the spot, for the simple reason that a piece of gold is exactly the same as a brick, and that a drop of water is the same as a piece of granite. Science knows that all kinds of matter are alike and that they appear differently only because their electrons are grouped in a different way. It will even be possible for us to make our own food without first planting the seed, which grows into the plant, which is eaten by the animal, so that we in turn may eat the animal. Synthetic food made from rocks found at our doors 100,000 years hence will be far more palatable, far more nutritious, and less poisonous, than anything we eat today.

**I BELIEVE**

**¶ THAT the patent office in the future will be the mother of all great fortunes.**

The next few centuries will bring about a great era of simplification. Everything we are doing now is too cumbersome. Everything will be freed from complexity. Our lives are entirely too crowded. Where we used to have countless wires and cables, slowly these are making way for radio, where no wires are required. Railroads will be discontinued when aerial navigation comes into general use. Reading and studying of books is already on the wane due to the greater educational and entertaining force of the motion picture. The printed page is being supplanted by the picture everywhere.

In some quarters, it is thought that this is a sign of retrogression of the race. Nothing could be more erroneous. The scientific explanation is very simple. Our lives are crowded to such an extent, that it is impossible to read as much as our grandfathers could. We are constantly being speeded up mentally and if a picture can tell the story in two seconds why should one read a typed story which might occupy 10 or 15 minutes of one's time. This, by the way, is the answer to the unprecedented popularity of the New SCIENCE AND INVENTION magazine.

**THE GOLDEN AGE OF SCIENCE**

**is now symbolized by the golden cover of SCIENCE & INVENTION. LOOK FOR THE GOLD COVER every month!**



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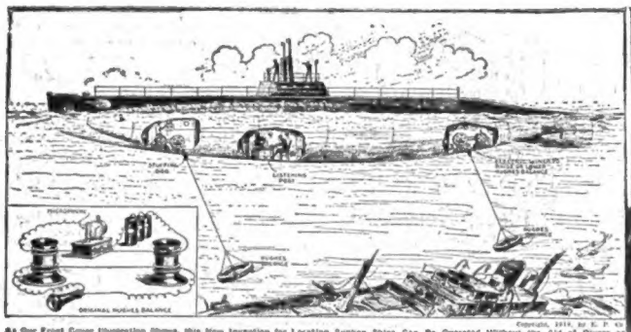
# Electric Finder Saves $30,000,000



As Our Front Cover Illustration Shows, this New Invention for Locating Sunken Ships Can Be Operated Without the Aid of Divers or Diving Machines. It is Based on the Hughes Induction Balance, Where a Slight Change in the Induction Between Four Balanced Coils Causes a Sound to Be Heard in One of the Circuits.

## Treasure Ships Located Electrically

By H. GERNSBACK

THE salvage of 440 vessels and the recovery of property valued at $250,000,000 is the record in four years of the British Admiralty Department, which under Rear-Admiral Philpotts has been conducting salvage operations in home and foreign waters.

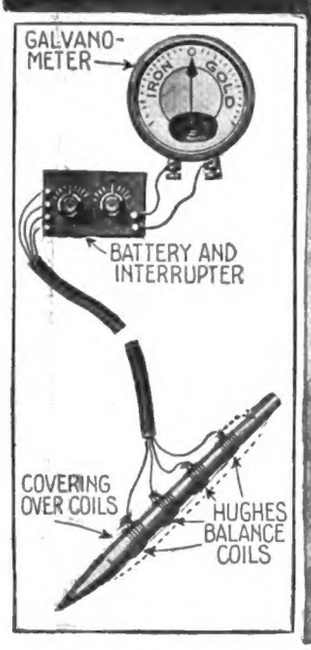
Thus reads a recent newspaper clipping. But the $250,000,000 worth of property recovered represents only a very small percentage of the ships that had been sunk during the present war as well as during the past century.

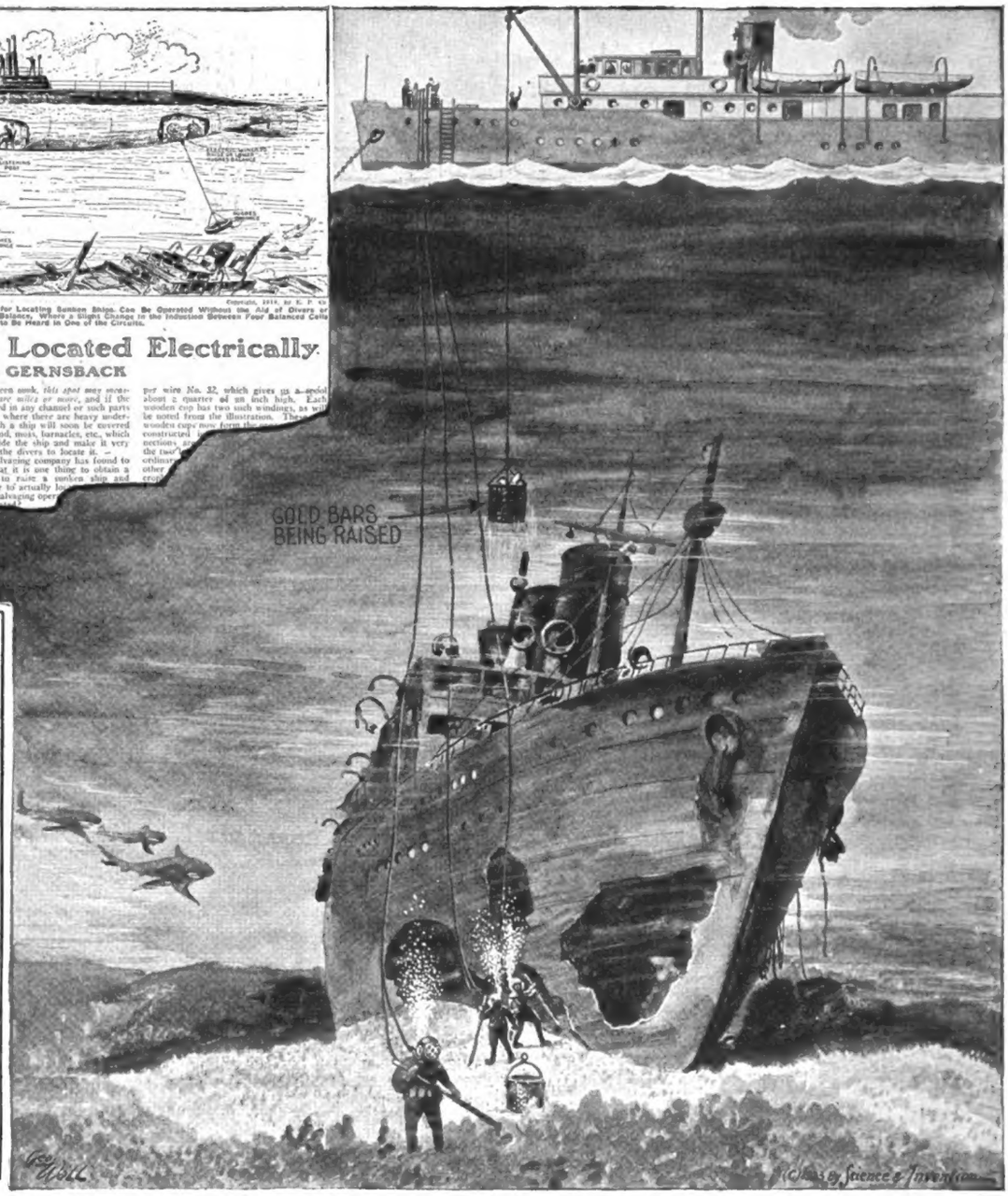
The ocean is dotted with sunken ships containing such fabulous treasures that it is difficult for the mind to grasp the enormous figures. It runs way up into billions, and while

a ship has been sunk, *this spot may encompass five square miles or more*, and if the ship is located in any channel or such parts of the ocean where there are heavy undercurrents, such a ship will soon be covered over with sand, moss, barnacles, etc., which effectively hide the ship and make it very difficult for the divers to locate it.

Many a salvaging company has found to its regret that it is one thing to obtain a commission to raise a sunken ship and quite another to actually locate to start the salvaging oper-

per wire No. 32, which gives us a coil about 2 quarter of an inch high. Each wooden cup has two such windings, as will be noted from the illustration. These wooden cups now form the constructed sections, the other ordinary




**A recent cable dispatch from London states that thirty million dollars in gold bullion was successfully raised by divers working ninety feet below the surface of the sea. The divers used a special electric spear and indicating device, which showed whether the spear point was touching gold or base metal. Such an electric divining rod was foretold and described by H. Gernsback in the October 1919 issue of this journal, then called the ELECTRICAL EXPERIMENTER, part of this article appearing in the upper left hand corner of the picture. The four coils of the Hughes balance are carefully balanced electro-magnetically, so that the galvanometer needle points to zero. Metals brought near the coils disturb this balance.**

## AN APPRECIATION

*AS this issue is going to press, we are in receipt of literally thousands upon thousands of letters from our readers enthusiastically endorsing our new policy of "Science in Pictures." It is impossible to answer each and every one of these wonderful letters and the Editor takes this occasion to convey his thanks to the thousands of our friends who have taken the trouble to write us. We have made a number of improvements in this issue which we trust you will notice—but we are not as yet satisfied. We hope to increase the size of this magazine very shortly and to give you a good deal more material than we are giving you now.*

*You will note also that with this issue we have improved our cover so that the Gold will not rub off. This improvement has been made at a very high cost but we simply must satisfy our readers.*

*In the meanwhile, all we ask of our friends is to show SCIENCE AND INVENTION to their friends, and we shall thank you for doing this.*

*EDITOR.*

### A FEW OF THE GOOD THINGS IN DECEMBER SCIENCE AND INVENTION.

Fossilized Extinct Animals,
By Dr. W. A. Luz

Salvaging Sunken Ships by Freezing Them in Ice,
By Charles Martin.

An Airplane-Helicopter Flyer,
Magic for Everybody,
By Joseph Dunninger.

Driven Airplane Now Practical,
By Dr. A. Demuth.

A Marvelous Self-Propelling Ship,
By Edward H. London.

Tricks With Matches,
By Walter B. Gibson.

What Famous Magicians Think of Spiritism.

Measuring the Heat from Distant Stars,
By Edison Pettit, Astronomer at the Mt. Wilson Observatory.

How to Make Your Own Storage Battery.

"Bob Cat"—A Wind Sled Driven by Motorcycle Engine,
By G. A. Luers.

How Miniature of Actor Appears in Same Movie,
By Phil Gersdorf.

Combined Self-Feed Drill Press and Lathe,
By F. G. Marsa.

Butterfly Trays—How to Make Them,
By Dr. Ernest Bade.

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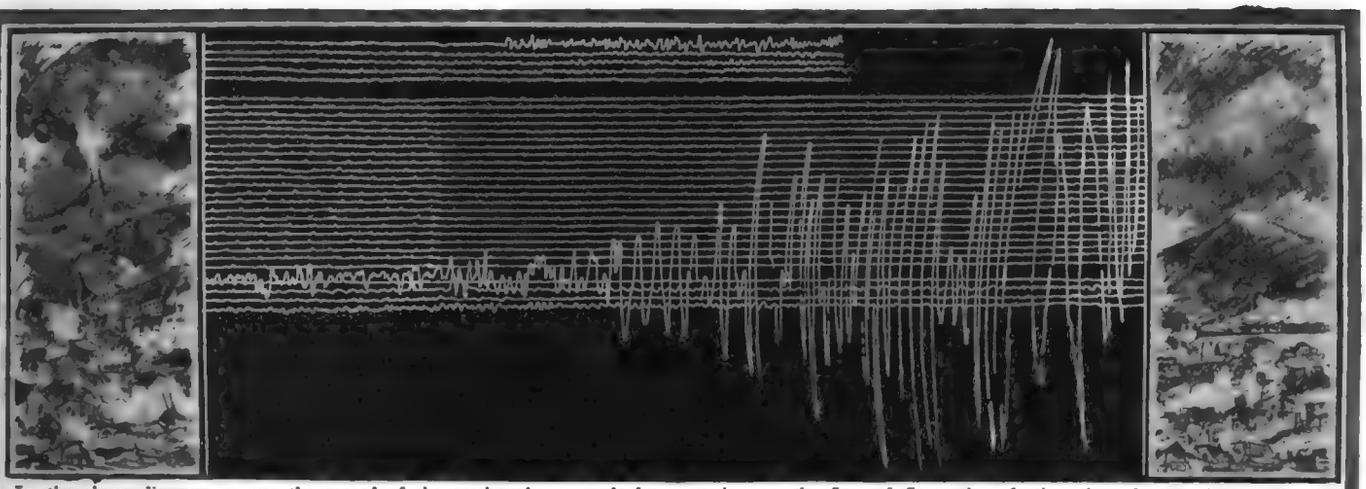
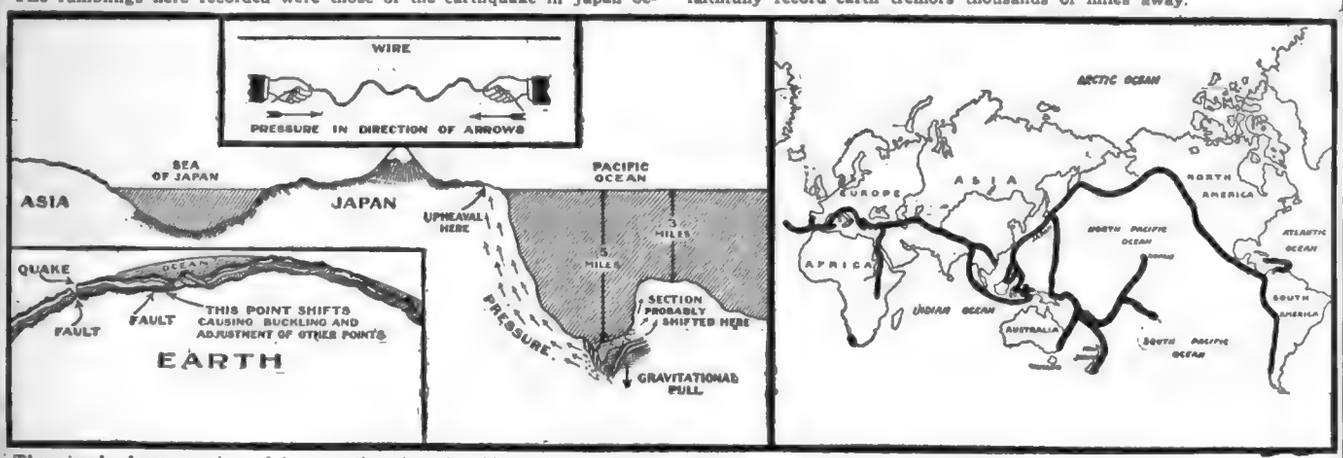
# Earthquakes and Their Causes

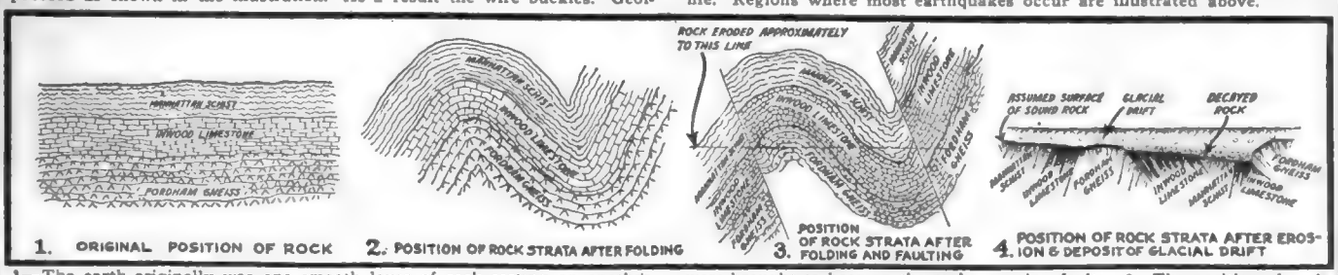
By EDWARD H. LONDON



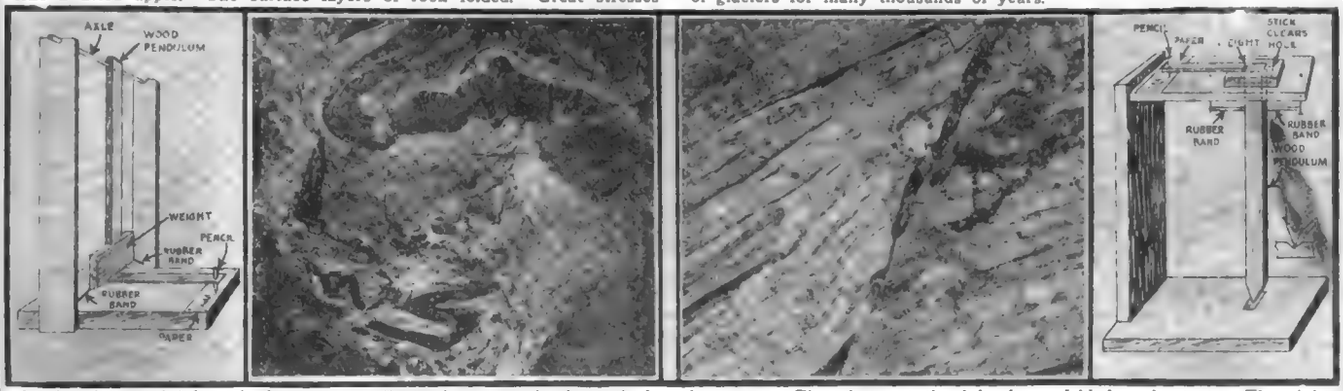
In the above diagram we see the record of the earthquake as made by the seismograph at the Saint Maur Park Observatory in Paris, France. The rumblings here recorded were those of the earthquake in Japan occurring on the first of September, lasting three hours, eleven minutes and twenty-three seconds. The seismograph is so sensitive that it can faithfully record earth tremors thousands of miles away.




The simple demonstration of how earthquakes "work" is shown above. A straight piece of wire (or a sheet of paper) is held in the hands and pressed as shown in the illustration. As a result the wire buckles. Geologists believe a wedge of rock shifted near the foundation of the volcanic island of Japan. This caused pressure producing the upheaval and loss of life. Regions where most earthquakes occur are illustrated above.


MANHATTAN SCHIST
INWOOD LIMESTONE
FORDHAM GNEISS
ROCK ERODED APPROXIMATELY TO THIS LINE
ASSUMED SURFACE OF SOUND ROCK
GLACIAL DRIFT
DECAYED ROCK
1. ORIGINAL POSITION OF ROCK
2. POSITION OF ROCK STRATA AFTER FOLDING
3. POSITION OF ROCK STRATA AFTER FOLDING AND FAULTING
4. POSITION OF ROCK STRATA AFTER EROSION & DEPOSIT OF GLACIAL DRIFT

1—The earth originally was one smooth layer of rock resting on another. 2—Then the earth cooled and the surface became wrinkled and furrowed like a dried apple. The surface layers of rock folded. Great stresses were brought to bear on the rocks, causing faults. 3—The position of rock after faulting. 4—Shows the position of rock after erosion and the action of glaciers for many thousands of years.




At the right and left end of the above illustration, two simple methods of making a seismograph at home are illustrated. Both weights are held in place by rubber bands. A pencil attached makes the record on a moving paper. The photo at the left shows folded rock strata. The right shows a fault. Rock sliding along the line of this fault may cause an earthquake by pressing surrounding rock.

Photos courtesy N. Y. Municipal Board of Water Supply.

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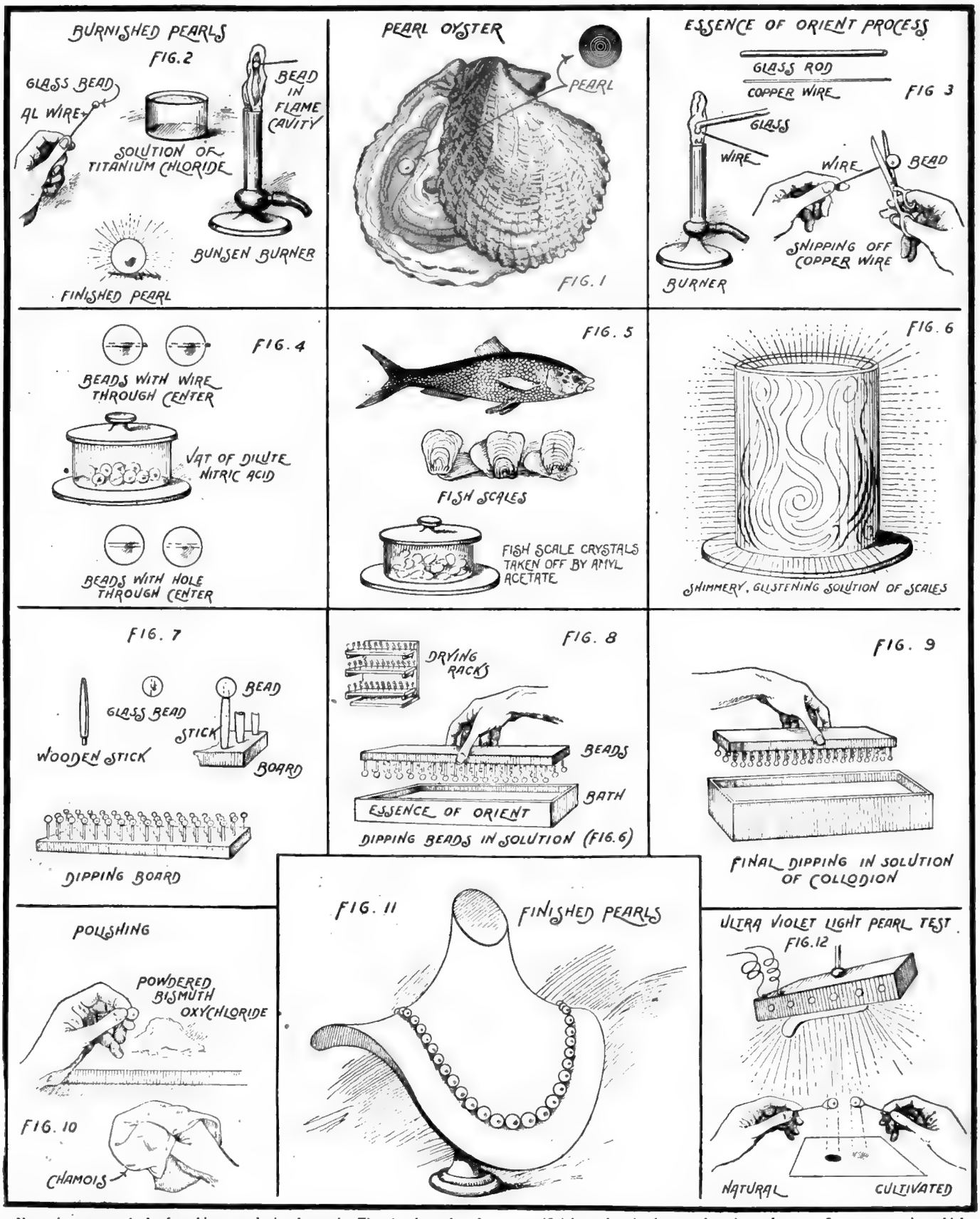
# How Artificial Pearls Are Made

By ISMAR GINSBERG, B. Sc. Chem. Eng.




Nature's own method of making pearls is shown in Fig. 1. A grain of sand or other foreign substance becomes embedded in the flesh of a mollusc. A secretion takes place and covers up the nucleus. Years are required to make a pearl by this method. Science, however, does it more quickly. At Fig. 2 is shown the method of manufacturing cheap imitation pearls. A bead of glass is made opaque and covered with an irridescent material, usually titanium chloride. After being dipped into the solution the bead is held in the flame of a Bunsen burner. It is then dipped again. Beginning at Fig. 3 is shown the method of making the better artificial pearls. A glass nucleus is made on a fine copper wire which is later removed with nitric acid. A small stick is inserted into the hole. Many of these nucleii are then made fast to a board and dipped into "Essence of Orient" which is made by dissolving bleak and shad fish scales in amyl acetate. The film is allowed to dry and the process repeated until the pearl is built up. The completed pearl is then polished with powdered bismuth oxychloride. Pearls made by this method can only be distinguished from the genuine by splitting them or with the aid of ultra-violet light rays, as shown in the last figure on the page.

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# Movies from Your Victrola

Your Victrola becomes a movie projector with the aid of the Jenkins movie machine. Two powerful lights cast their rays on the pictures to be shown. The reflection passes up through a lense and a system of mirrors and is shown on the screen. The film is printed on the edge of paper disks the size of phonograph records.

This movie machine works on the same principle as the old-time post card projector. The heavy light falling on the pictures reflects them onto the screen. Several disks are used. The pictures are printed in a circle around the edge. As each disk is shown it is raised and the one below it is projected.

# Night Plane Altitude Indicator

**By S. R. WINTERS**

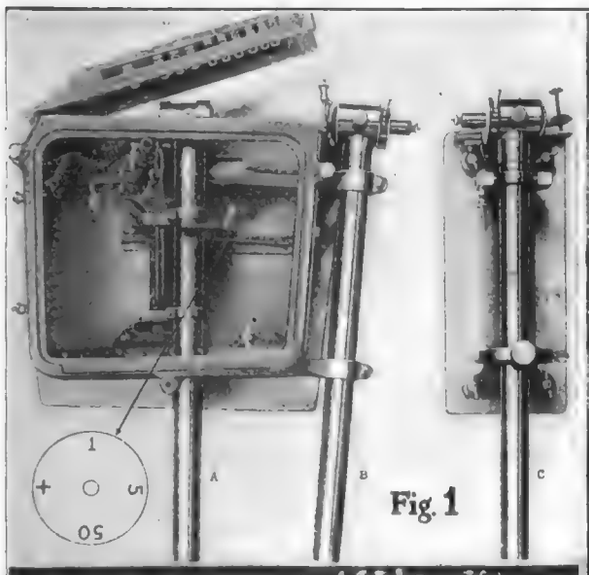



Fig. 1

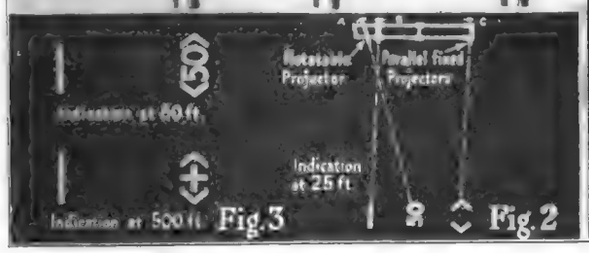
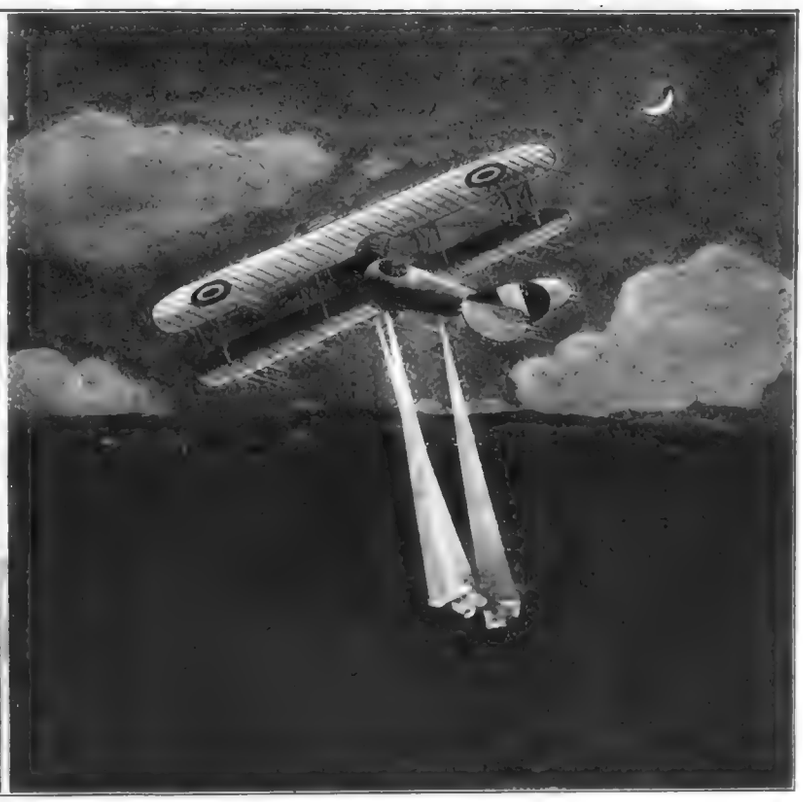



Fig. 3 Fig. 2



The hazard is taken out of night flying with the device shown above. With it a pilot can tell his exact height when he is flying within 500 feet of the ground. The movable beam of light shows a number. When this number falls between the arrow-heads the plane is above the ground the number of feet indicated by the beam. As he comes closer the beam travels toward the front bar of light. When it reaches the front bar it disappears and a second numeral, fifty feet less than the other, appears between the arrow-heads, indicating a new distance. So if "100" appeared midway between the two marks it would indicate that the plane was half [illegible] 100 and 50 feet, or 75 feet high. Invented by C. Francis J[illegible]

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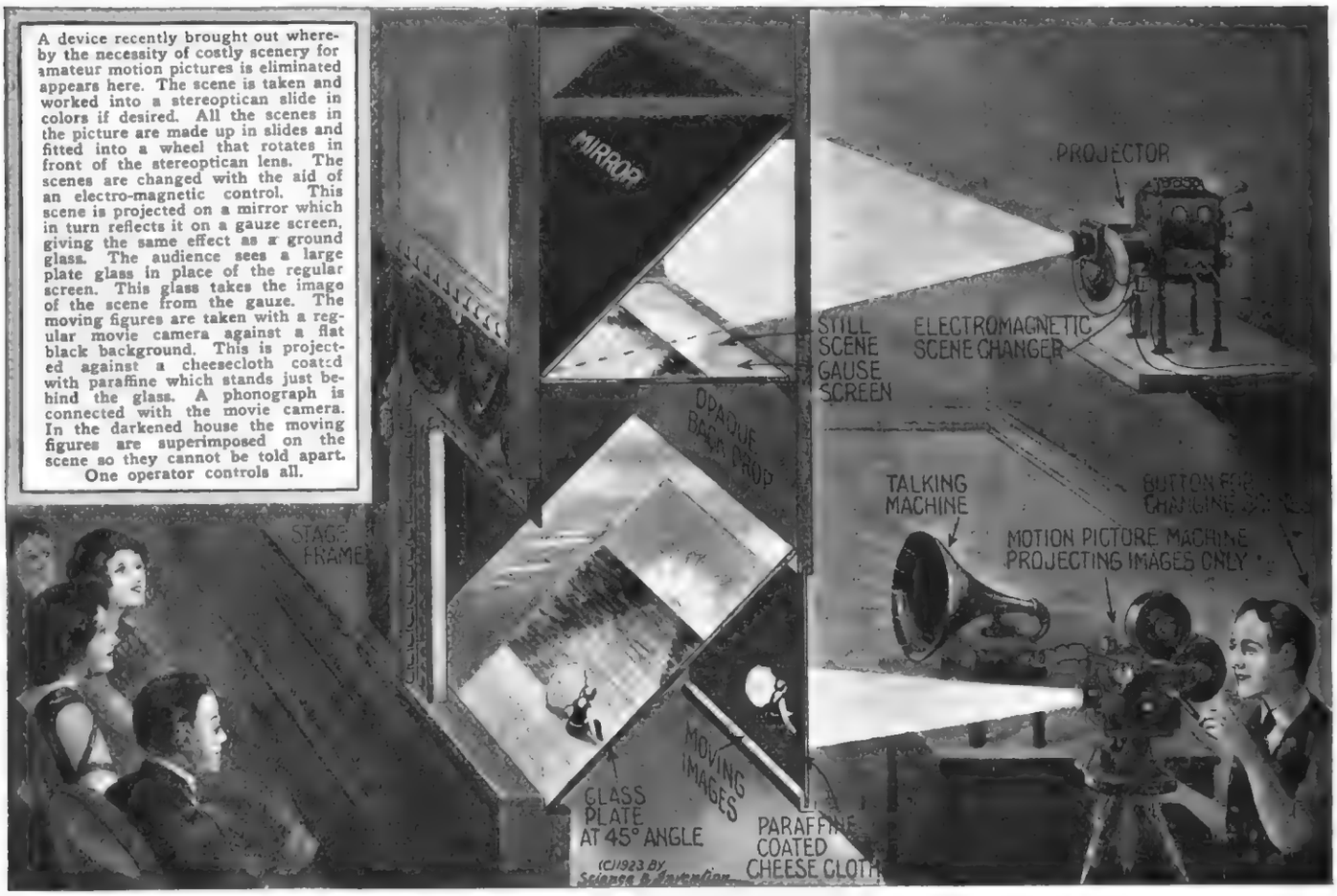
# Moving Objects On Still Scenes

A device recently brought out whereby the necessity of costly scenery for amateur motion pictures is eliminated appears here. The scene is taken and worked into a stereoptican slide in colors if desired. All the scenes in the picture are made up in slides and fitted into a wheel that rotates in front of the stereoptican lens. The scenes are changed with the aid of an electro-magnetic control. This scene is projected on a mirror which in turn reflects it on a gauze screen, giving the same effect as a ground glass. The audience sees a large plate glass in place of the regular screen. This glass takes the image of the scene from the gauze. The moving figures are taken with a regular movie camera against a flat black background. This is projected against a cheesecloth coated with paraffine which stands just behind the glass. A phonograph is connected with the movie camera. In the darkened house the moving figures are superimposed on the scene so they cannot be told apart. One operator controls all.




## $12,000 or More in Gold

Beginning with the January issue, SCIENCE AND INVENTION will pay $1,000.00 or more each month of the year in prizes. Every article published in the regular news section will receive one of them. (The departments have awards of their own which they will continue to give.)

Ideas are what the editors want. They must be told simply—so your mother or sister can understand them—in pictures and sketches. Be sure they are NEW and have something to do with science or invention. The editors want pictures and sketches—

88 monthly prizes will be given as follows:

| | | | |
|---|---|---|---|
| **FIRST PRIZE** | | | **$100.00** |
| **2 PRIZES** | | **of** | **$50.00 each** |
| 10 | " | " | 25.00 " |
| 5 | " | " | 20.00 " |
| 10 | " | " | 15.00 " |
| 20 | " | " | 10.00 " |
| 10 | " | " | 5.00 " |
| 20 | " | " | 2.00 " |
| 10 | " | " | 1.00 " |

## $12,000 or More in Gold

must have them—but ideas are wanted most of all.—And they will be handsomely paid for. The rules of the contest will be found on page 534 of the October issue. If you haven't a copy, one will be mailed you free on receipt of your name and address. It will give full details of the rules and hints on submitting articles. The closing date for all prize contributions will be the 15th of the month preceding date of issue, i.e., 15th of December for the February number; the 15th of January for the March number, etc.

## WILL YOU BE OUR REPORTER?

**IN connection with our $12,000.00 prize contest announced last month, it goes without saying that you will have to hustle to win a prize. The Editors do not wish to make it hard for you; quite the contrary. We want the pictures and want them badly. Herewith is reproduced our reporter's card. We shall be glad to send it to anyone who makes an application. By means of this card, you will be able to secure entré into industrial plants, business houses, motion picture studios, steamships, mines, etc. This card will prove an open sesame to you in many instances. Each card is numbered and only one is given to a correspondent. A postal card from you and a request for this reporter's card is all that is necessary for obtaining one. It will be sent you by return mail. Address Field Editor, SCIENCE AND INVENTION, 53 Park Place, New York City.**

REPORTER

**Science and Invention**

**CORRESPONDENT REPORTER'S IDENTIFICATION NO. 999**

THE BEARER OF THIS CARD John Doe

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**EXPERIMENTER PUBLISHING CO.**

(over)

H. Gernsback PRESIDENT

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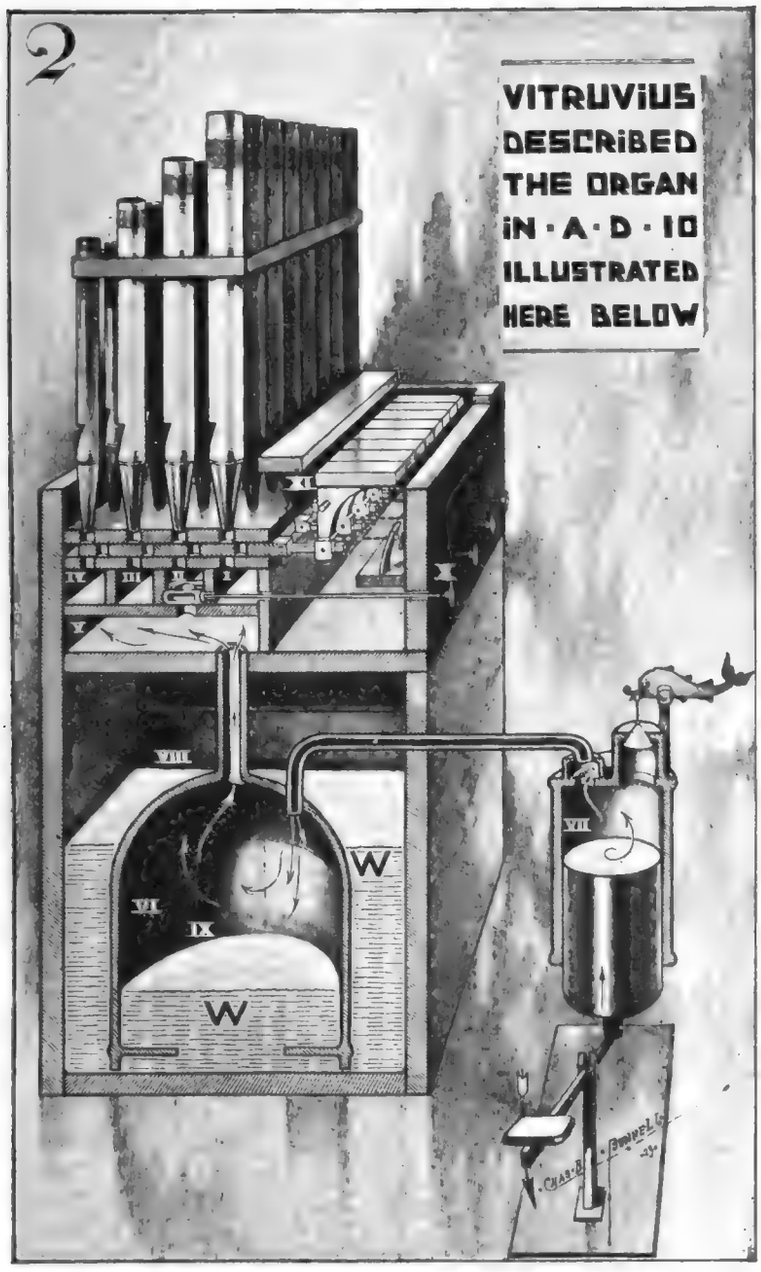
# Antique Organs

**By CHARLES BEECHER BUNNELL**

2

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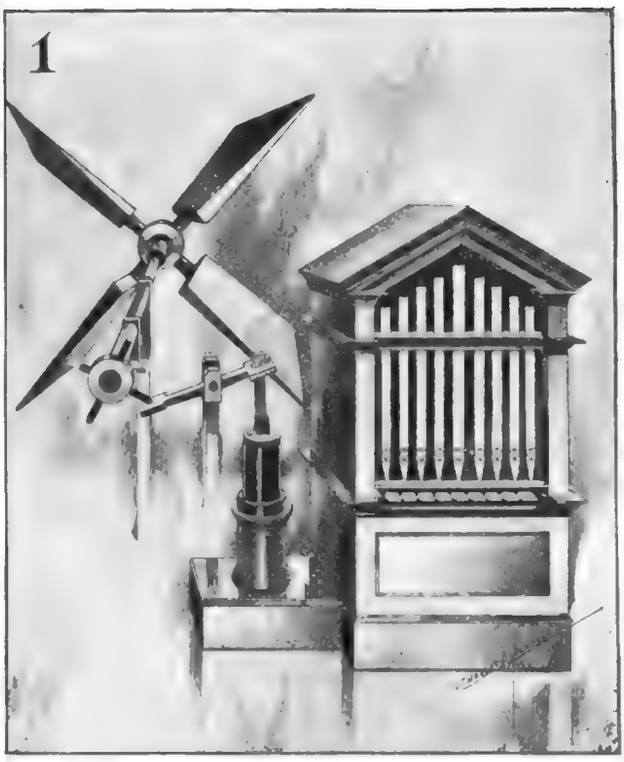
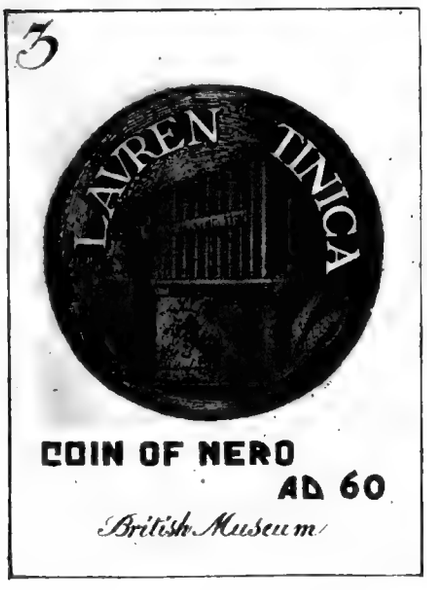


THAT the organ is a very old instrument is testified to by the fact that it is mentioned in the early chapters of the Bible (Genesis iv, 21). The first specific account of it, giving full mechanical details of its construction, however, is that set down by Hero of Alexandria, 280 B. C. In this account, Hero's father, Ctesibus, is credited as having evolved the invention. The sketch shown above (Fig. 1) is a reproduction made from Hero's description of the instrument. Although the drawing illustrates the organ as being operated by wind power, passages in the account tell of instances where the instrument was run by water wheels as well as by man power. The valves governing the tones and key-board are omitted from the drawing since more than forty different varieties of them are mentioned in the written account of the instrument.

AT the left is shown a drawing depicting full mechanical details of the instrument as set out in one of the accounts by Vitruvius, a Roman engineer, obtained from the Alexandrian Library when the city was captured. As shown, it was equipped with a foot pump, a hydraulic reservoir, and valves to the pipes which had a range of four octaves. The push-button-like affairs on the front of the organ opened the air ducts I, II, III, or IV which governed which of the four octaves were to be played. Each key of the key-board was a four-way affair and played the same note in each octave. The octaves could be combined or played separately. A horn spring kept the keys up in place when they were not pressed. Differences in volume were obtained in varying the openings of the octave keys which governed the amount of air admitted to the pipes. The water reservoir kept the pressure of the air constant while the organ was being played.

3




Nero may have played his fiddle while Rome burned but when he wanted a soothing quiet hour at one of the 856 public baths he listened to organ music. The baths were only one-tenth bath. The other nine-tenths was club, according to all accounts, for they were equipped with courts, wine rooms, restaurants, lounges and even organs. After a hard day at martyring Christians and feeding his enemies to the royal tigers he would retire to a bath for a quiet evening. And that he enjoyed music on the bath organ on these occasions is attested by the fact that he had a coin struck (left) showing one of these instruments. This coin was found by antiquaries and is now in the British Museum.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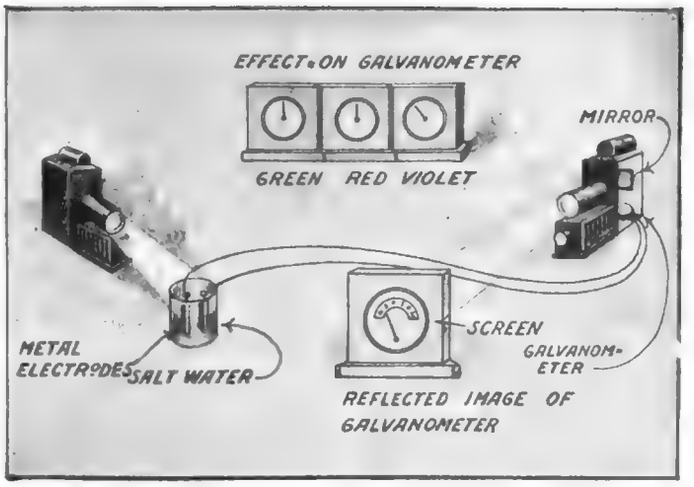
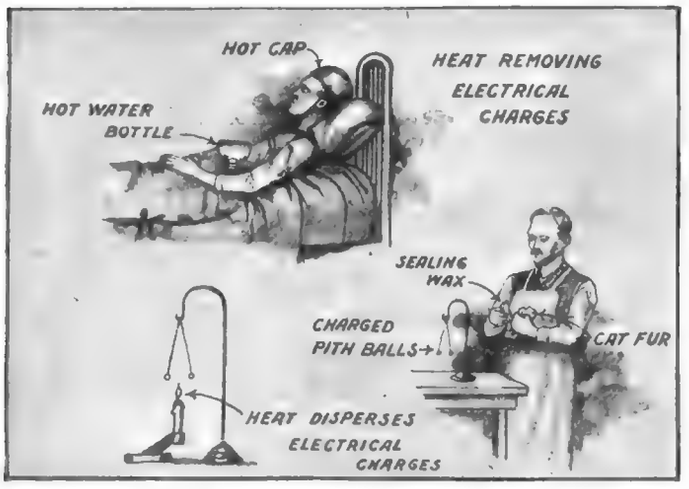
# Medical Hokum Exposed

By JOSEPH H. KRAUS
STAFF MEDICAL EXPERT

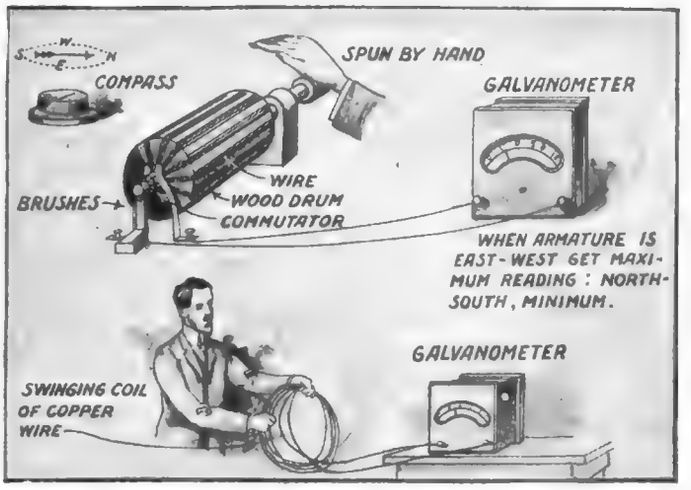
Unless the moon hung in exactly the right quadrant and the proper shade of light was available at the time of your birth you had small chances to live, according to Dr. J. C. Burnett, president of the alleged Burnett-Timpken Research Laboratory, who made public these somewhat startling if hardly probable facts in a New York lecture recently. Comes the doctor and relates the fact that green light will kill an embryo, just following the formation of the heart.



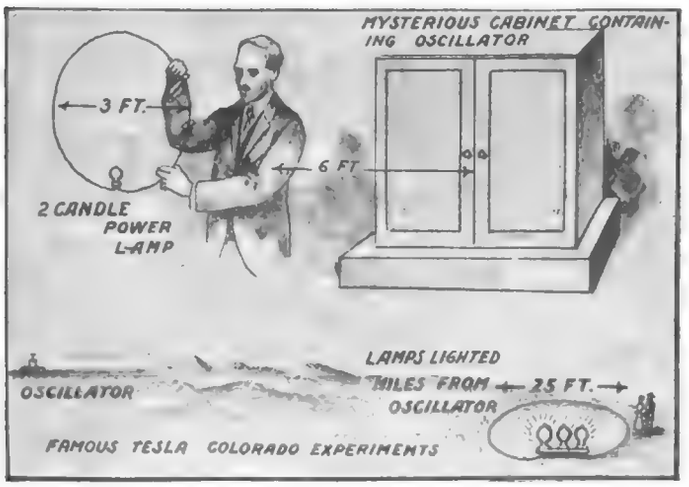

Further, this medical gent deposes and says that all chemical reaction is merely electro-magnetic change in matter, and that, such being the case, electrical currents should be used in the treatment of disease. By way of proving this fact the brother stuck two electrodes in a dish of water (salt was undoubtedly added to it) and turned different colored lights on it. The galvanometer registered differently for each, which undoubtedly proves that colored lights do cure (?) diseases. It does—not.



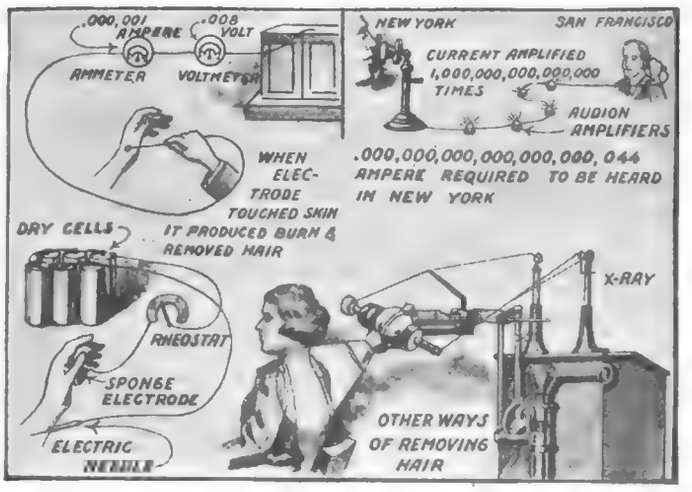

But the doctor gets the beautiful 7½" x 5¼" custard pie as a prize for this excellent piece of whim-wham: The reason, says he, that hot appliances cure diseases is that the heat applied tends to remove electrical charges from the affected parts. By way of proving this scientifically the doctor suspends two pith balls that have been charged and then brings a lighted candle near them. The balls come together. Presto, all proved. Heat disperses the juice therefore cures disease. See photo above.




But hold, quoth the hangman. The most epochal discovery from this bag of flim-flam is the device for detecting earth magnetic currents. Note the amateur armature in the above sketch. By setting it east and west, across the earth's magnetic field a deflection is obtained on the galvanometer. Wonderful! Bravo, doc,—that is, bravo if every high school physics text didn't contain this experiment. You certainly are the great little discoverer—of physics texts.




The assembled sages of the American Osteopathic Association, before whom these far-reaching discoveries were dispensed gave a howl of applause at this one (shown above) that would make Valentino jealous. The doctor lighted a light without connections. The mystery maker was a Tesla resonator.




Above is some of the "laboratory's. . . finest measuring instruments made." See the readings of the Volt- and Ammeters and then consider the telephone amplification for fineness. He found out that electricity would kill hair but he didn't know what the X-rays would do. He'll discover that in a couple of years, let's hope.

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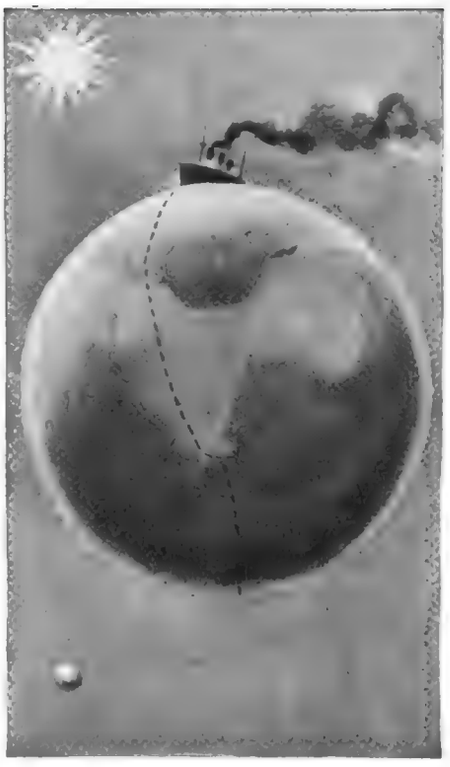
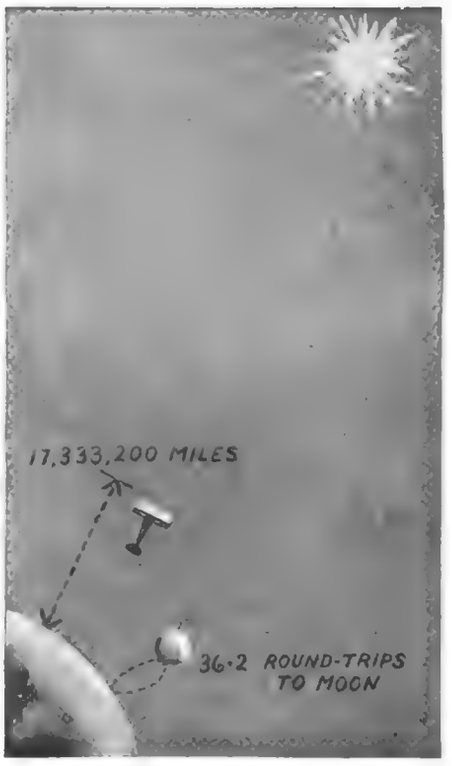
# World's Energy From Atomic Force

The Energy Released by the Disintegration of One Gram of Gold Would Yield Enough Electric Power to Light 21,666 Homes for One Year According to Dr. Paul D. Foote, Member of the U. S. Bureau of Standards.

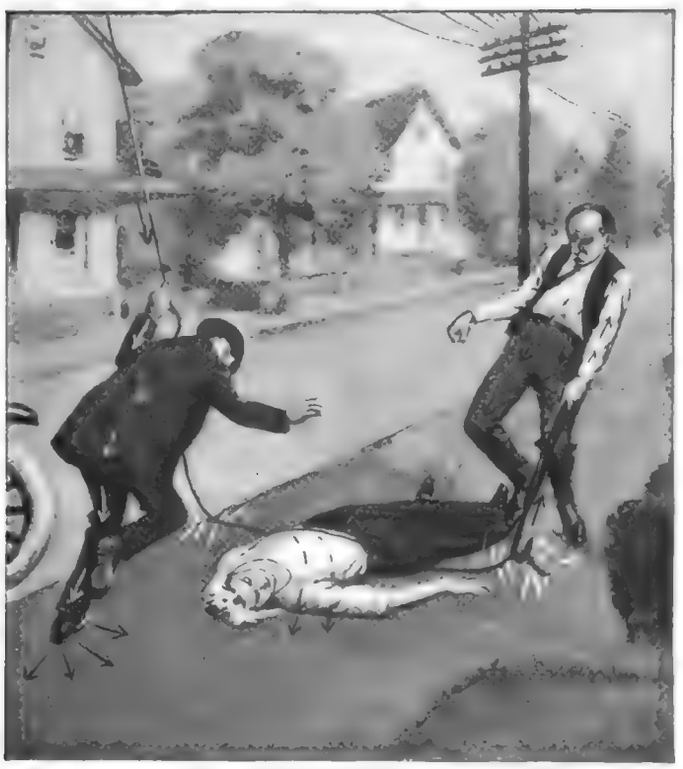


The Transmutation of the Same Gram of Gold Would Be Sufficient to Propel a Transatlantic Liner Around the Globe. The Energy Thus Liberated Would Reduce the Gold to a Base Metal Similar to Lead.




The Old Alchemists Sought to Make Gold, the New Ones Seek to Destroy It and Use Its Energy. The Atomic Force of a Gram of Gold Also Would Drive an Airplane to the Moon and Back 36 Times or 17,333,200 Miles.

# Weird Deaths From Stray Currents



Trying to Save a Friend, a New Jersey Man Recently Lost His Life When He Tried to Remove a Feeder Wire from the Friend's Body with the Aid of an Umbrella. He was Standing on the Pavement and the Moment He Touched the Cable He Was Instantly Killed. The Umbrella Was Burned Up.

A Light Circuit Grounded to Its Conduit Caused the Death of a Brooklyn Householder When He Stepped Into Water that Covered the Floor of His Basement. The Cellar Floor Was Insulated but the Steps Were Not, So the Current Shunted Through His Body and Instantly Killed Him.

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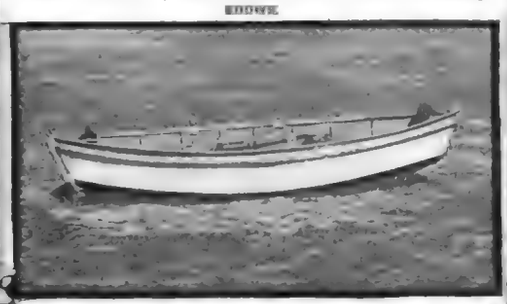
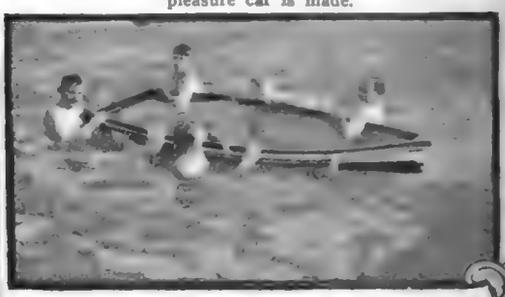
# Automobile Sled—Non-Sinkable Boat

An auto truck equipped with runners and a spiked drum at the rear, which enables it to travel over deep snow.

By removing the rear wheels from a touring car and substituting a spiked drum and runners, a winter pleasure car is made.



This neat row boat, constructed entirely of Duraluminum, was made by a German aircraft company.



Because of specially constructed air chambers with which the row boat is equipped, it is impossible to sink it.

# Can You Be a Movie Star?

Have you a camera face? If you are not sure and want to know, get the old T-square, dividers and yard-stick and find out for yourself. If you would portray the trials of Tessie or exploit the story of the rising young district attorney, you must first have a face conforming with rigid specifications. According to Allan Dwan, producer and director, the selection of actresses for the movies has become a thing of pure science. Here are some of the specifications determining the filming qualities of a face. The lines of the chin must form an obtuse angle when looked at squarely, and the distance from the point of the chin to the base of the nose, must equal [illegible]stance from the tip of the [illegible]oint exactly midway [illegible]e eye-brows.

Above——The distance from ear to ear over the forehead measured with a tape measure must equal the distance from the apex of the chin to the exact crown of the head. The separation between the eyes should equal the size of one eye. The top of the ear should be even with the eye-brow. The shape of the nose has nothing to do with the screening of a star.

Left—The nose of a star should not project any more than ¼ of an inch maximum. Pictures were posed by Mary Thurman, well-known photoplay star. —By Harry Van Demark.

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# The Newest Radio Photo-Play

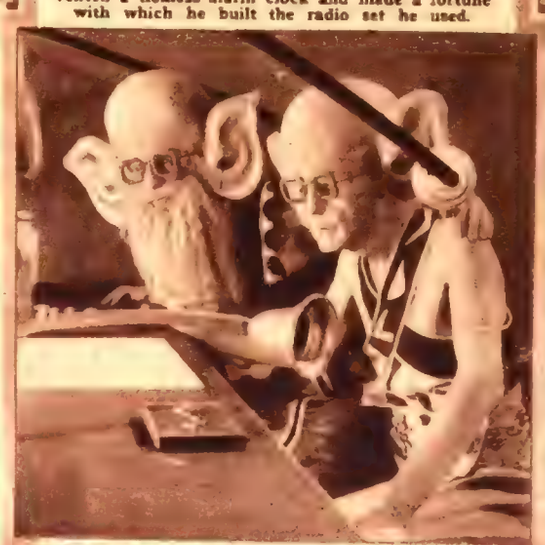
Ambition to communicate with Mars by radio is the central reason for the existence of "Radiomania," just completed Hodkinson picture starring Grant Mitchell, shown above at his radio station.

A couple of plates, with the assistance of his fiancee and hoped-to-be mother-in-law serve to demonstrate the workings of the solar system.

A Martian radio station, as depicted by the picture. The radio apparatus used in the photo-play was all especially built by the Western Electric Co. Note the large ears on the Martians.

A typical Martian home is shown above. Before Mitchell communicates with the planet, he invented a tickless alarm clock and made a fortune with which he built the radio set he used.

That the Martians are interested in monstrosities just as inhabitants of the earth are is shown by the fact that they have elaborate museums—according to the picture.



The tense moment. Martian radio operators, doing a little "DX" stuff at their station, pick up the earth on the loud speaking phones.

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# Around the Universe

## By RAY CUMMINGS

5TH INSTALLMENT

They entered the Milky Way on the seventh day after passing Alpha Centauri. Though their actual entrance into the Galactic Plane was unmarked, the firmament simply blazed with bright stars.

### CHAPTER IX.

**In which the voyagers plunge into the darkness of space beyond the milky way, and two most felicitous events occur simultaneously.**

THE car passed between the component stars of Alpha Centauri during the early afternoon of the following day. The two gigantic blazing suns were four times our own sun in apparent diameter. Their light was intolerable to the naked eye. Even with the shades of the side windows drawn, the interior of the vehicle was disagreeably bright.

The heat was tremendous—almost stifling. All that morning the temperature had been rising, until, at lunch time the two men again appeared in their white flannels, and Ameena was back to her charming native costume.

During the morning the two stars that compose Alpha Centauri had visiually separated, and Sir Isaac laid his course between them—a thing that was possible only because the vehicle's tremendous velocity precluded even these gigantic masses from drawing it aside and into them.

The actual passage between the stars was very brief, fortunately, or the voyagers would have perished in the intolerable heat. Sir Isaac estimated the stars to be some 3,600,000,000 miles apart. He professed ignorance as to what figure the earthly astronomers had set, and admitted his estimation probably was greatly in error since he had nothing to judge it by save the stars' apparent flight upward past the side windows. It was indeed, only a few seconds before they were above the vehicle and visually again drawing together.

When it was over, Sir Isaac, trembling at the keyboard, turned his white face to his companions and smiled weakly.

"I should not have tried that," he said. "It was too dangerous, attempting to pass through that little space. How I ever managed it—"

He broke off, adding:

"Well, we're past now, at all events. I did not want to slow down—but suppose—just suppose we had run too close to one of those stars—suppose we *had* collided with one of Alpha Centauri's planets?"

"Was there any planets?" asked Tubby. "I didn't see none."

"Neither did I," Sir Isaac confessed. "I did not see anything. There might have been—I do not know." He took a swallow of water from the carafe on the table, lighted a cigarette—he was smoking incessantly—and went back to the mathematics in which he was now constantly engaged.

Tubby watched him timidly for a moment. Then, encouraged by a glance from Ameena, he said, hesitatingly:

"Where we goin' next, perfessor?"

Sir Isaac looked up, frowning. "Eh? What's that?"

"I said, where we goin' next? You said this mornin' we wouldn't stop at Alpha Centauri, but you forgot to tell us why."

Sir Isaac, still working on his plans, had made a brusque statement to that effect. He had promptly immersed himself in his mathematics again, so Tubby and Ameena had thought it best to let him alone temporarily. They had spent almost the entire morning together in the little observatory upstairs, where, through the small telescope they had tried to locate the Solar System.

Sir Isaac, during the morning, had reached a definite conclusion; and now in the face of Tubby's ingratiating attitude, his austerity melted a little, and he retailed his plans.

#### SIR ISAAC TELLS HIS PLANS

I did not stop at Alpha Centauri," he said, "because I calculated that the time

"There is our Sun," said Sir Isaac—"and there is Betelgeuse. Our Sun is about 15½ light years from here—Betelgeuse is about 150.

#### SYNOPSIS OF FOUR PRECEDING INSTALLMENTS OF "AROUND THE UNIVERSE."

WATCHING a game of cards, "Tubby" suddenly finds himself out in the open under the stars, endowed with a power of wishing. He wishes for a knowledge of astronomy and is confronted by a Professor Isaac Swift DeFoe Wells-Verne. They start for Venus in the Professor's space flyer.

Arriving, they meet Ameena, an inhabitant of Venus and she tells them that the earth is going to be attacked by Martians and the Twilight People of Mercury. The three decide to set out to the various planets to solicit aid, in behalf of the earth. They land on Jupiter and are interviewed by the Great Mogul who laughs at them and refuses help

Leaving Jupiter they head out into space, passing near the rings of Saturn. Arriving at Uranus, they find that it is not inhabited. The same condition is found on Neptune. Therefore, in hopes that some of the stars are inhabited, they head toward Alpha Centauri.

In the last installment the Professor is left figuring out a most abstruse mathematical problem.

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we would lose in checking our present high velocity and starting again, would, after a very few stops, exhaust all the time at our command." He smiled in friendly fashion, and explained in detail.

"But then," protested Tubby, "if we don't never stop, how are we goin' to get any help?"

Sir Isaac hesitated. "To be quite frank with you, my friends, I have about concluded we cannot get any help."

"Oh," said Tubby.

"Oh dear," Ameena echoed faintly.

Sir Isaac continued.

"I think we can save our earth alone—through our own efforts—without any outside assistance."

Coming from such a meticulous person as Sir Isaac this was good news indeed. Tubby and the girl vociferously demanded details.

Sir Isaac raised his hand. "I have not worked it out yet. That's why I didn't want to tell you anything about it. The plan involves a tremendous, a very abstruse and delicate mathematical calculation. If I can secure complete and exact enough figures the execution of my plan will be very simple. I am working on the calculation now. I worked all last night—all this morning. It may require many days—I do not know. But if only my strength holds—"

"You go right ahead," encouraged Tubby. "We won't bother you none. And meantime—"

"In the meantime," Sir Isaac supplied, "I thought we might as well go onward." He smiled with just a touch of embarrassment. "To tell you the truth, I am very curious about these outer realms of space. I have lots of good theories—but I really *know* very little about this portion of the Universe."

"Me neither," Tubby declared liberally.

"And," Sir Isaac went on, "since we have attained this high velocity, and are each moment accelerating it, I thought we might as well utilize our spare time to—well just to satisfy our curiosity. I have a theory regarding the edge of Space—"

"Ah! The edge of Space!"

"Yes, the very ultimate edge of this Space we are traversing. If we could reach it and return with my calculation completed, and then save our Earth, it would—"

"Great!" cried Tubby.

"We can! We will!" cried the girl.

**"Well," said Sir Isaac, "that was a gigantic building alongside of which we went down—a building fifteen or twenty miles high. Those huge yellow rectangles were its lighted windows. That ball of fire was a street light. We descended directly into a city street and collided, probably with the coat sleeve of a pedestrian."**

"—it would gratify me very much," Sir Isaac finished.

Thus it was arranged. Tubby and Ameena returned to the observatory—the only part of the vehicle where they could sing with abandon and without fear of disturbing Sir Isaac.

Two hours later they came quietly down to indulge in afternoon tea. In the instrument room, sprawling in his chair, with his arms on the table and his head upon them in the midst of a litter of papers covered with algebraic hieroglyphics, sat Sir Isaac, fast asleep.

"Poor dear man," murmured Ameena. "He is completely worn out."

"Yeh, he's all in," agreed Tubby. "Let's get him to bed."

They awakened him gently, and ordered him up to one of the bedrooms. Like a child, he obeyed. On the stairs he roused himself sufficiently to caution Tubby.

**SPEED AND DANGER INCREASE APACE**

"I want you to look ahead through the floor window at least once every minute," he declared. "We have very little room, even out here, at this velocity. I have several times barely avoided collisions that I haven't told you about. If we approach closer than 900,000,000 miles—or even as close as that—to any celestial body of sufficient mass to deflect us, we are lost. Will you promise?"

Tubby promised; and this time, with Ameena's assistance, he kept his word.

As Sir Isaac explained to them the following morning, the danger of collision in one way was now very great, though in another way it had lessened. They had passed Alpha Centauri at a velocity per second of something like 275,000,000 miles. This, by steady acceleration, now approximated 740,000,000. Any very gigantic celestial body in front of them would deflect them aside and into it. It was this danger that they must avoid. But of course, so enormous a body would be visible an enormous distance away and so could be seen in time to be avoided.

On the other hand, there was now little danger to be apprehended from smaller bodies such as the asteroid with which they had so nearly collided back in the Solar System. Even if one of these should separate itself from the proximity of the larger worlds, its comparatively minute mass could not exert sufficient attractive force to make the slightest deflection in the course of the vehicle. For a collision to occur, therefore, one of these smaller bodies would have to lie *exactly* in the vehicle's path—a space of some forty feet which was the vehicle's width. And, as Sir Isaac remarked, any particular forty feet in these vast realms of outer Space was too small to be considered. Sir Isaac also pointed out that any asteroid would be invisible until it was quite n

(*Continued on page 715*) *on page* 9000 no

**Sir Isaac leaped back to the keyboard just as the vehicle struck something soft and yielding. There was a gigantic swish; the room tilted and trembled—then silence.**

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"Yes," explained the Lunar queen, "it is a movie of the murder as it really occurred. . . We obtained the pictures through the slowness of light." She waved her hand. A mirror appeared on the wall and the whole scene of the tragedy was enacted in natural colors.

# Doctor Hackensaw's Secrets

## By CLEMENT FEZANDIÉ

## No. 23
## What Dr. Hackensaw Found on the Moon

ON, on sped the car through space, and still Doctor Hackensaw and Pepita Perkins lay unconscious in their respective couches. It was not until the car was nearly at the end of its journey that the doctor's automatic devices awakened him from his profound sleep. Pepita, too, or "Pep," as she insisted on being called, awakened at the same time.

"In three hours, Miss Pep," observed the doctor, "we shall land on the moon."

"Yes, and in the form of burnt pancakes. You told me that already. Why did you wake me up?

"Because we must be prepared for any emergency. There is one chance in a thousand of our reaching the moon alive, and we must be prepared to grasp that chance. I have done all that was humanly possible to break the fall. Instead of shooting the car straight at the moon, I shot it so as to pass a little beyond the moon, thence to be pulled back by the lunar attraction to the side of the moon opposite to the earth. The car has thus a much shorter distance to fall. I also arranged that the moon should be speeding away from the car, hence the rapidity of the car's fall will be still further diminished, since it will be the difference between its own speed and the speed at which the moon is departing from it. Then, too, the attraction on the moon is considerably less than that on the earth. I have also arranged special devices for retarding the car at the proper moment.

"The front of the car, that is, the side turned toward the moon, is made in a series of compartments, each containing an explosive. Whenever I wish to decrease speed, I shall ignite the explosive in this front compartment. The compartment is shot off toward the moon, and its reaction shoots the car backwards a little, or, to speak more accurately, retards the car's speed. Each compartment can be exploded in turn. In fact, here goes the first. But I shall fill this room with mattresses to deaden the shock for us."

### PREPARING TO LAND ON THE MOON

So saying, the doctor pressed a button. The walls of the room opened, pivoted around, and Pep and the doctor found themselves each snugly ensconsed in a thick cushion of spring mattresses that filled the apartment. Then the doctor pressed a second button. A violent detonation followed. The front of the car shot off toward the moon like a cannon-ball, and the doctor was pleased to observe that the speedometer showed an appreciable reduction. Of course, the concussion was great, but the mattresses preserved the doctor and Pep from injury.

Finally, the last explosive was fired. The speed of the car, however, was now terrific, and the doctor was expecting the final crash to be fatal, when, to his astonishment, the speed gradually diminished. Objects in the car regained their normal weight, and the car landed as softly on the moon as if it were a feather.

Doctor Hackensaw was hugely astonished at this unexpected turn of affairs, and did not learn until later that he was indebted to the Selenites or inhabitants of the moon, for checking the speed of his fall and thus saving his life and that of his companion.

### MOON'S LACK OF ATMOSPHERE

The doctor, however, lost no time. Calling Miss Pep, the two soon arrayed themselves in the special suits prepared for exploring the moon. These suits were an absolute necessity. There being little or no air on the moon, a supply of compressed air had to be taken along. The absence of air, also, implied the absence of air-pressure. If the body were left unprotected, serious injury to the internal organs would result. Also, there being no atmosphere, the heat and light of the sun were not diffused, and the glare and heat would be intolerable. Protection from both was necessary.

"You see, Miss Pep," explained the doctor, "the moon's days and nights are not like ours. One day and one night make a month here. The sun shines here for fourteen days at a stretch, with an unbearable heat and glare, though the sky is dark in all other directions and the stars shine brilliantly. Then follow fourteen days of night, and the cold is intense. Without our suits we could not live an instant here, and without our goggles we should lose our eyesight!"

### THEIR FIRST VIEW OF A LUNAR LANDSCAPE

By this time the pair had emerged from the car and were viewing the new world. To Pep, who had looked at the moon through a telescope, the idea of a lunar landscape was a series of dead volcanic cones. But there was, in fact, luxuriant vegetation. Although there were some green plants among the number (if they could be truly called plants), the other colors of the rainbow seemed to predominate. As to the shapes, they were the most fantastic imaginable. Animals, too, of the most peculiar sort, could be seen playing about among the plants.

Pep was especially interested in one curious creature that had legs radiating from its body in six different directions and could roll in any direction by using four of these legs like the spokes of a wheel. Pep called these creatures the "Jacks" from their resemblance to the metal jackstones that children play with. There were also balloon-shaped creatures that floated about in the rare atmosphere, directing their course by means of paddles or fins. Another peculiar animal progressed by prodigious bounds in the air.

### "DOC" AND "PEP" FIND THEY WEIGH ABOUT 20 POUNDS ON MOON

At the very first step the pair made on the moon, Pep, too, found herself bounding high in the air. It was almost like the jour-

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ney in the car when objects had no weight at all. There, bodies had some weight, but much less than on earth.

"You see, Miss Pep," explained the doctor, "the moon is smaller than the earth and less dense, hence its attraction is less. On the other hand, bodies on the moon are nearer the center of attraction than bodies on the earth. This compensates to some degree for the lesser attraction. But, all told, bodies on the moon weigh only about one-sixth what they do on earth. You, for example, weigh 120 pounds on earth, but only twenty pounds here. Similarly, if you can lift 100 pounds on earth, you could lift six hundred pounds here with the same effort."

"Gee! Is that so? Let me see!" cried Pep. And irreverently picking up the doctor, she threw him up into the air. Up he went, twisting around and sputtering, his dignity even more upset than his person. He fell lightly, however, and in retaliation threw Pep into the air in the same manner.

At this instant, however, the doctor caught sight of one of the lunar machines, and instantly bounded towards it. Here at last the dream of his life was to be realized—he was viewing a machine such as mankind will not invent for hundreds of thousands of years to come! The machine was not of metal nor yet of wood, nor of flesh. It resembled no substance known to the doctor. The main part of the machine consisted of a series of spheres rotating about each other. They were not connected together in any way, but rotated somewhat as the planets rotate about the sun.

Doctor Hackensaw was overjoyed. "It must be a gravitation machine!" he cried gleefully. The Selenites have discovered the secret of gravitation and can work their machines without gears, connections, or bearings. "Oh, if I could only discover the secret!"

Close by the main machine was an auxiliary part. This bore some resemblance to a steam radiator with balls ascending and descending in spiral lines around the pipes. Long and closely did the doctor scrutinize the two machines without being able to understand either how they worked or what object they accomplished.

Then he felt himself pulled away by some invisible force, and as he turned he found that his companion was sobbing.

The Lunar landscape proved to support a great, luxuriant vegetation. Although there were some green plants among them the other colors of the rainbow predominated.

Close by the main machine, which consisted of a number of unconnected spheres rotating about each other, there was an auxiliary part. The doctor examined it long but could not discover its purpose.

"Why, what's the matter, Pep!" he exclaimed. "You're surely not crying? I felt all along that your gayety was unnatural. Tell me, what is the trouble. Is it the fear that we shall never get back to earth again?"

"No, no, no," cried the young girl in agony. "I never want to get back to earth again. Doctor Hackensaw," she added, "I'll tell you all. You were surprised to see me in the car, but the fact is I had to get away from the earth. In plain words, I am accused of murder, and there's a warrant out now for my arrest! But, doctor, I swear that I am innocent. I confess that many a time I've wanted to kill the man who ruined my life, but I never had the courage to do the deed. It was probably some other victim of his that did it. But she used a knife that belonged to me, and I was known to have threatened him. Luckily I learned of my danger in time to make my escape. I knew I should not be safe on earth, so I decided to accompany you to the moon, and here I am!"

Doctor Hackensaw shook his head. "You ought to have stayed at home and trusted to finding proofs of your innocence. You certainly won't find them here on the moon." A rather rash statement, however, as the sequel was to prove.

(*Continued on page* 710)

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# Height Test for Aviators

For testing the reaction of muscles and nerves in prospective aviators, a closed cylinder in which all atmospheric conditions of airplane flight can be duplicated has just been put into service by French aeronauts. The cylinder is shown in the large central circle. With this device the pilot's physical adaptibility is safely tested.

Air can be extracted or admitted to the cylinder in such a way as to give an exact replica of a rising or falling plane. The future aviators wear oxygen masks and recording instruments that give a record of all their reactions to the synthetic flights and falls. All instrument wires, air and cooling pipes come in under the floor.

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INTERIOR VIEW OF THE CAISSON

PROVIDED WITH OXYGEN MASKS, THE PILOTS ASCEND SEVERAL THOUSAND METERS

EXTERIOR CONTROL APPARATUS AND APPLIANCES

BELL JAR CONNECTED TO THE CAISSON

The operator sitting with the men under test observes their actions. He controls connections to the instruments, one of which records the rarity of the air corresponding to altitude, another the fall in temperature. A third records the pilot's movements. The most important one is shown to the left. It records the effect of height on the pilot's ability to act quickly; tests the response of his motor nerves which is of utmost importance.

CURRENT COMING FROM CAISSON

APPARATUS RECORDING THE PSYCHOMOTIVE REACTIONS AND THE RESISTANCE OF THE PILOT AT DIFFERENT ALTITUDES (IN THE PHYSICIAN'S OFFICE)

BAROGRAPH RECORDING THE FICTITIOUS ALTITUDE

RECORDER OF THE PILOT'S MOVEMENTS

TO THE REGISTER OR RECORDER

BAROMETERS

BREATHING MASK FOR THE OXYGEN

VALVE FOR REGULATING THE TEMPERATURE

EXHAUST CONNECTION (THE ASCENT)

AIR INLET (THE DESCENT)

IN THE CAISSON – THE CONTROLS

CONNECTING TUBES TO OXYGEN CYLINDER

INTERRUPTER CONTROLLING THE RECORDER

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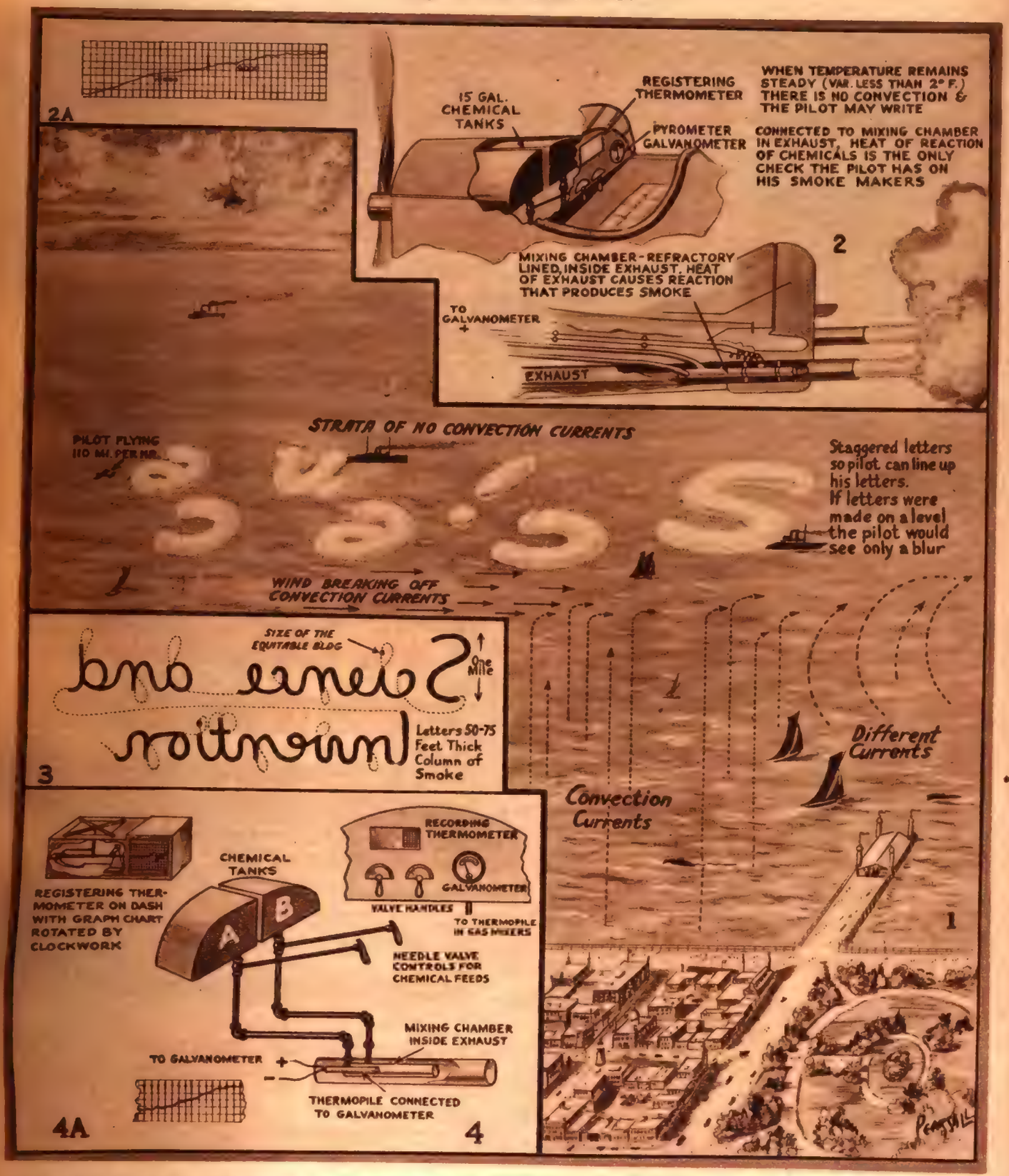
# Sky-Writing--An Exact Art

**By W. B. ARVIN**


2A
15 GAL. CHEMICAL TANKS
REGISTERING THERMOMETER
PYROMETER GALVANOMETER
WHEN TEMPERATURE REMAINS STEADY (VAR. LESS THAN 2° F.) THERE IS NO CONVECTION & THE PILOT MAY WRITE
CONNECTED TO MIXING CHAMBER IN EXHAUST, HEAT OF REACTION OF CHEMICALS IS THE ONLY CHECK THE PILOT HAS ON HIS SMOKE MAKERS
2
MIXING CHAMBER - REFRACTORY LINED, INSIDE EXHAUST. HEAT OF EXHAUST CAUSES REACTION THAT PRODUCES SMOKE
TO GALVANOMETER
+
EXHAUST
PILOT FLYING 110 MI. PER HR.
STRATA OF NO CONVECTION CURRENTS
Staggered letters so pilot can line up his letters. If letters were made on a level the pilot would see only a blur
WIND BREAKING OFF CONVECTION CURRENTS
SIZE OF THE EQUITABLE BLDG
One Mile
Letters 50-75 Feet Thick Column of Smoke
3
Different Currents
Convection Currents
1
RECORDING THERMOMETER
GALVANOMETER
CHEMICAL TANKS
A
B
REGISTERING THERMOMETER ON DASH WITH GRAPH CHART ROTATED BY CLOCKWORK
VALVE HANDLES
TO THERMOPILE IN GAS MIXERS
NEEDLE VALVE CONTROLS FOR CHEMICAL FEEDS
MIXING CHAMBER INSIDE EXHAUST
TO GALVANOMETER
+
−
THERMOPILE CONNECTED TO GALVANOMETER
4A
4

Writing 10,000 feet in the air with a column of smoke 75 feet thick using letters a mile high, and at the same time driving a light airplane at 110 miles an hour around sharp corners requires exactness at the very least. You may take the word of the inventor, Major Jack Savage, for it. First the sky-writer has to find a strata of air where there is no convection. This is done with a recording thermometer, (detail in sketch 4A). When the graph paper shows a flat stretch (Fig. 2A) there is no change in temperature and therefore no convection and the pilot may write—if there is a heavy wind, for the letters are written at a distance from the point of the observers and then allowed to be blown into their vision by the wind. Major Savage told the writer he does his best writing in a seventy-five mile an hour gale.

Fig. 1 illustrates the method of staggering the letters 100 feet over each other.

Fig. 3 shows the way the writing is done—backwards. The dot on the "I" is the size of the Equitable Building in New York. At Fig. 2 is shown the chemical writing apparatus and the instrument board installed in the light plane which is used. Fig. 4 shows in detail the two mixing tanks from which the smoke-producing chemicals flow back to the mixing chamber in the exhaust where the heat causes them to combine into 250,000 cubic feet of smoke per second. It requires about 15 gallons of the two mysterious chemicals which the Major calls "A" and "B" to write the name SCIENCE AND INVENTION. In day-time white letters are used. Or three colors may be used together, such as red, white and blue. Luminous letters are used at night. The writing will last from ten to forty minutes, depending on the condition of the air.

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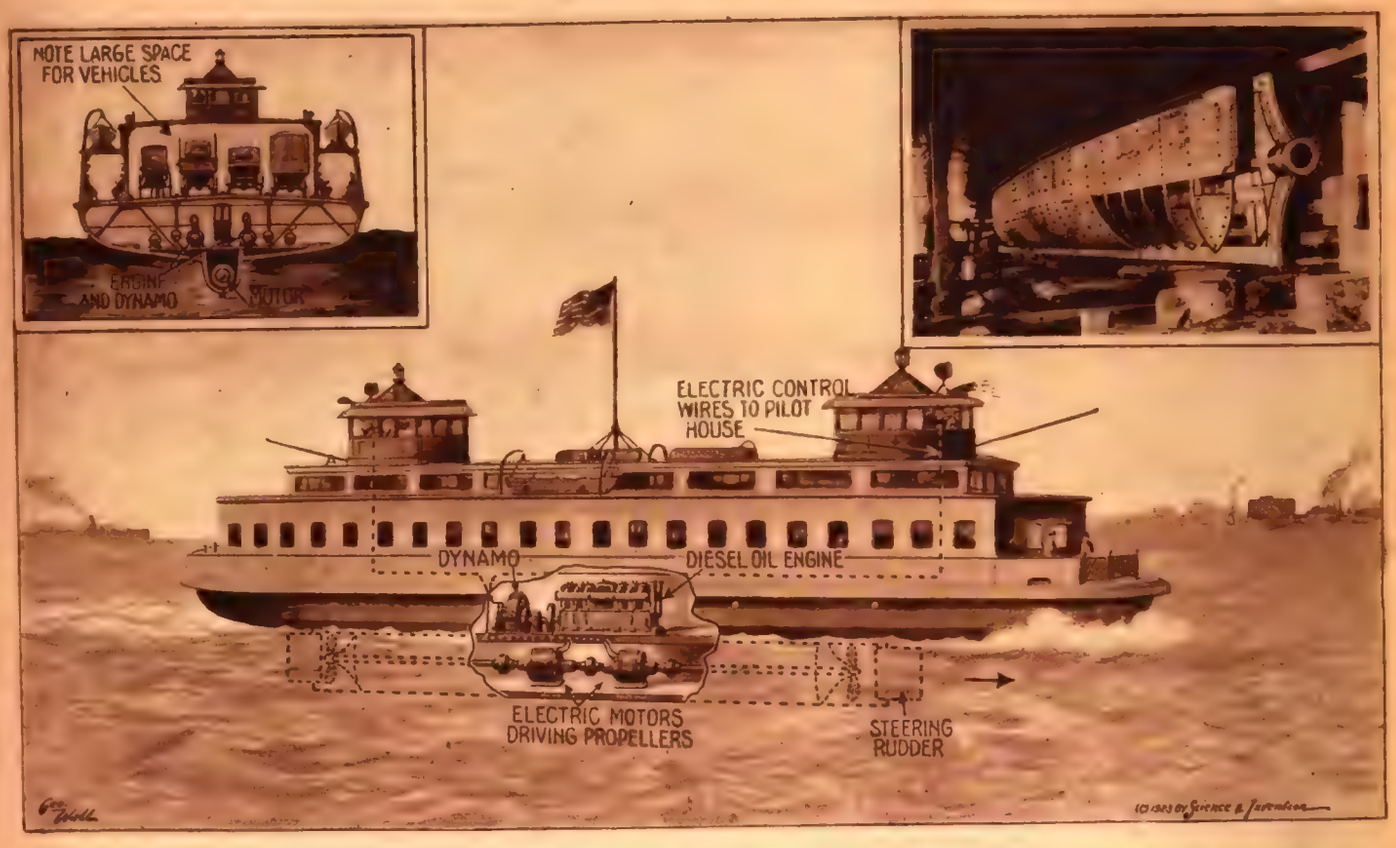
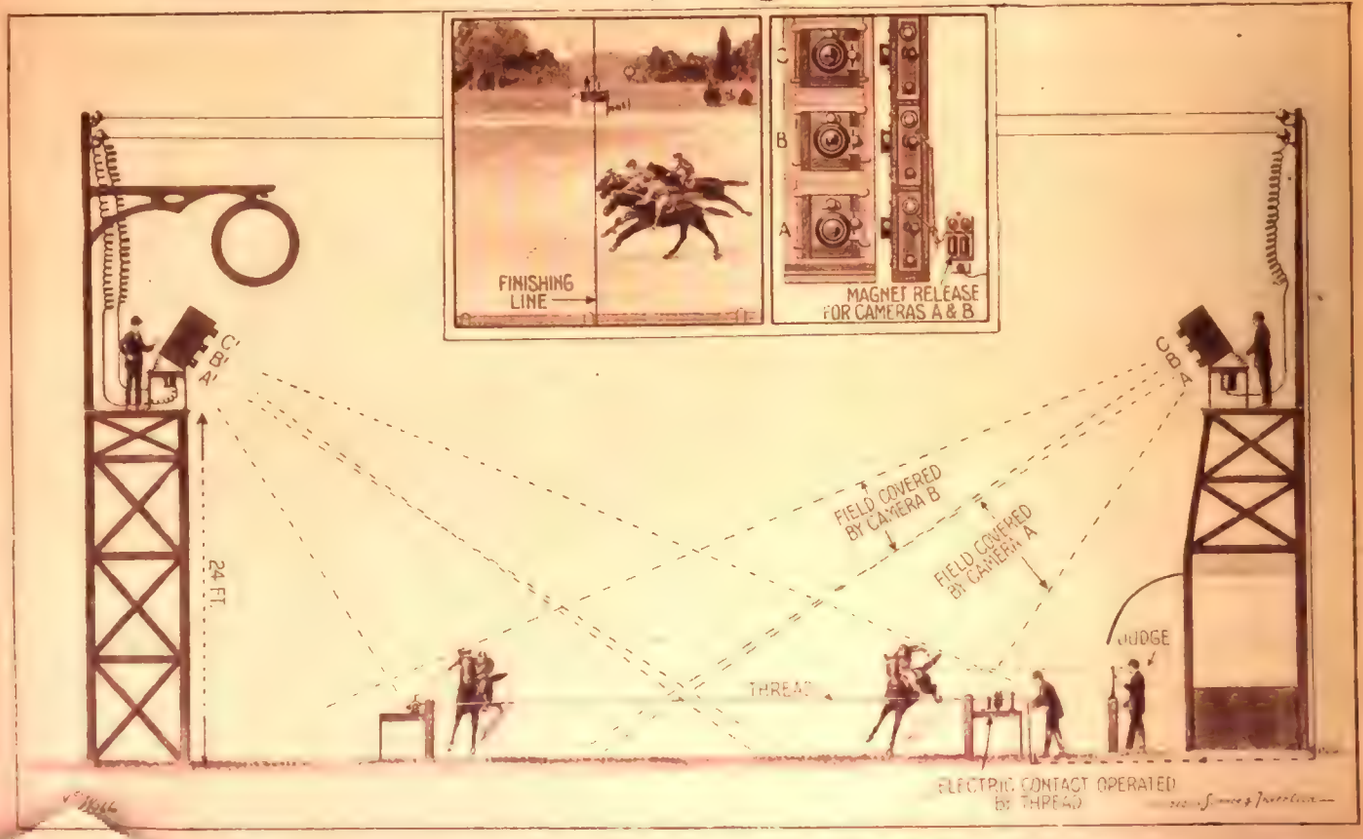
# Electrically Driven Ferryboat




An electrically driven ferryboat with much larger carrying capacity than the old type steam-driven boats has just been put in service by Captain Samuel Golden, the inventor. The boat is entirely controlled from either pilot house. It can be easily maneuvered and is stable in ice and rough weather.

# Camera Used to Judge Horse Races




...ding a s ...nibicab ...ing out of deciding a close race, the Maisons-Laffitte course ... above ! ...evods ...bacameras placed above the finish wire. The horses coming to the wire break a thread which trips the camera shutters. The pictures are finished four minutes after the race. Camera C catches the "place" horses.

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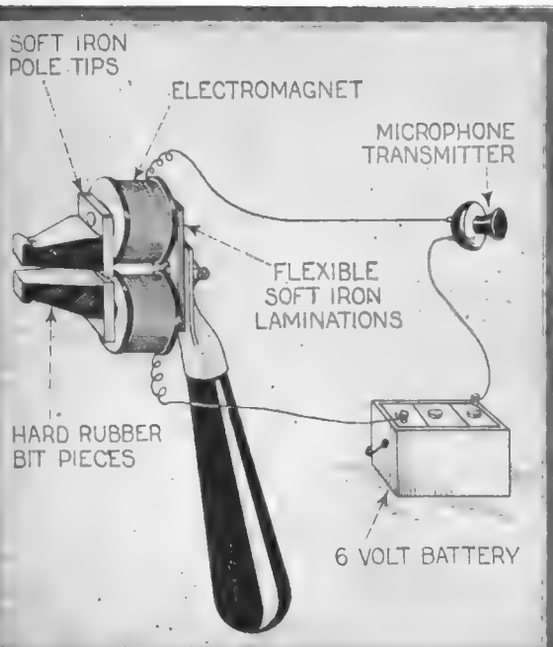
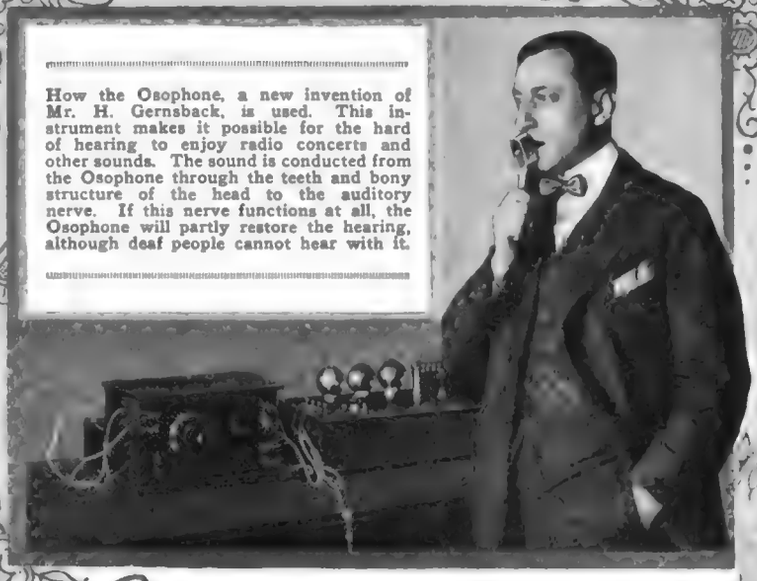
# Hearing Through the Teeth

**By H. GERNSBACK**



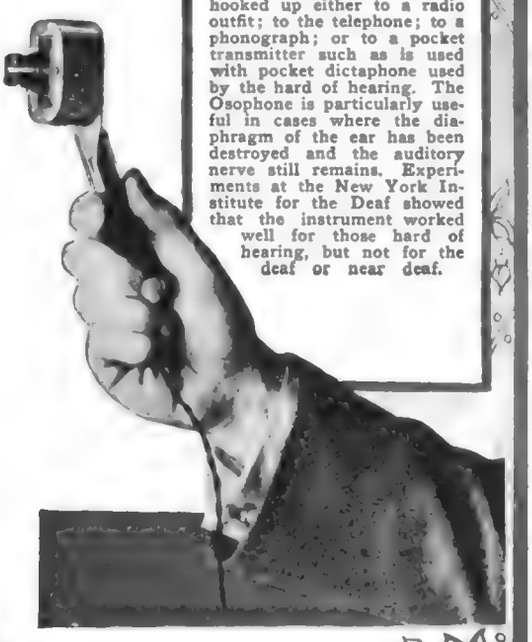

The Osophone consists of two electro-magnets mounted on flexible soft iron laminations. Two hard rubber bit pieces are placed between the teeth. The instrument works best when not bitten too hard. The two soft iron pole tips move to and fro when the Osophone is in operation and the sounds are thus transmitted.

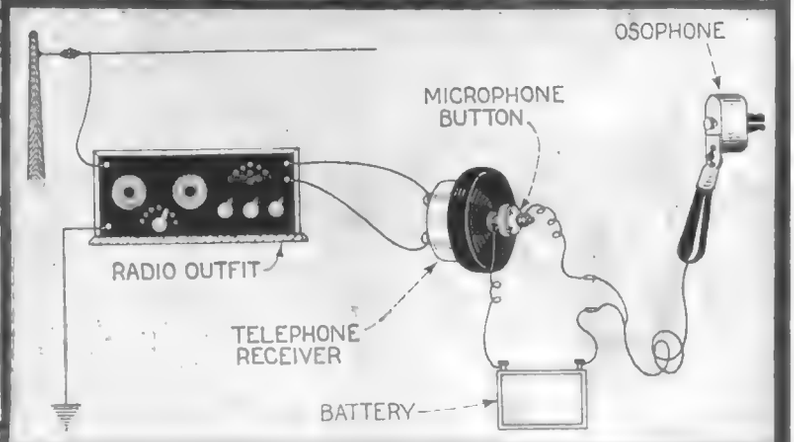
How the Osophone, a new invention of Mr. H. Gernsback, is used. This instrument makes it possible for the hard of hearing to enjoy radio concerts and other sounds. The sound is conducted from the Osophone through the teeth and bony structure of the head to the auditory nerve. If this nerve functions at all, the Osophone will partly restore the hearing, although deaf people cannot hear with it.



How to talk to a friend hard of hearing. Mr. H. Gernsback at the right demonstrates the instrument to a person of normal hearing. In order to hear with the Osophone a normal person must close his ears tightly; then the sound transmission is entirely through the teeth. A person hard of hearing using the Osophone would not, of course, have to close his ears.

At left is shown a close-up of the Osophone. It can be hooked up either to a radio outfit; to the telephone; to a phonograph; or to a pocket transmitter such as is used with pocket dictaphone used by the hard of hearing. The Osophone is particularly useful in cases where the diaphragm of the ear has been destroyed and the auditory nerve still remains. Experiments at the New York Institute for the Deaf showed that the instrument worked well for those hard of hearing, but not for the deaf or near deaf.






Hook-up of Osophone to a radio outfit. An ordinary 1000 ohm telephone receiver has mounted in the center of diaphragm one of the well-known microphone buttons. The Osophone is then connected in series with the microphone button and with the battery. The resistance of the Osophone is only about 5½ ohms in order to pass powerful currents. Sound coming through the telephone receiver operates the microphone which in turn energizes the Osophone.

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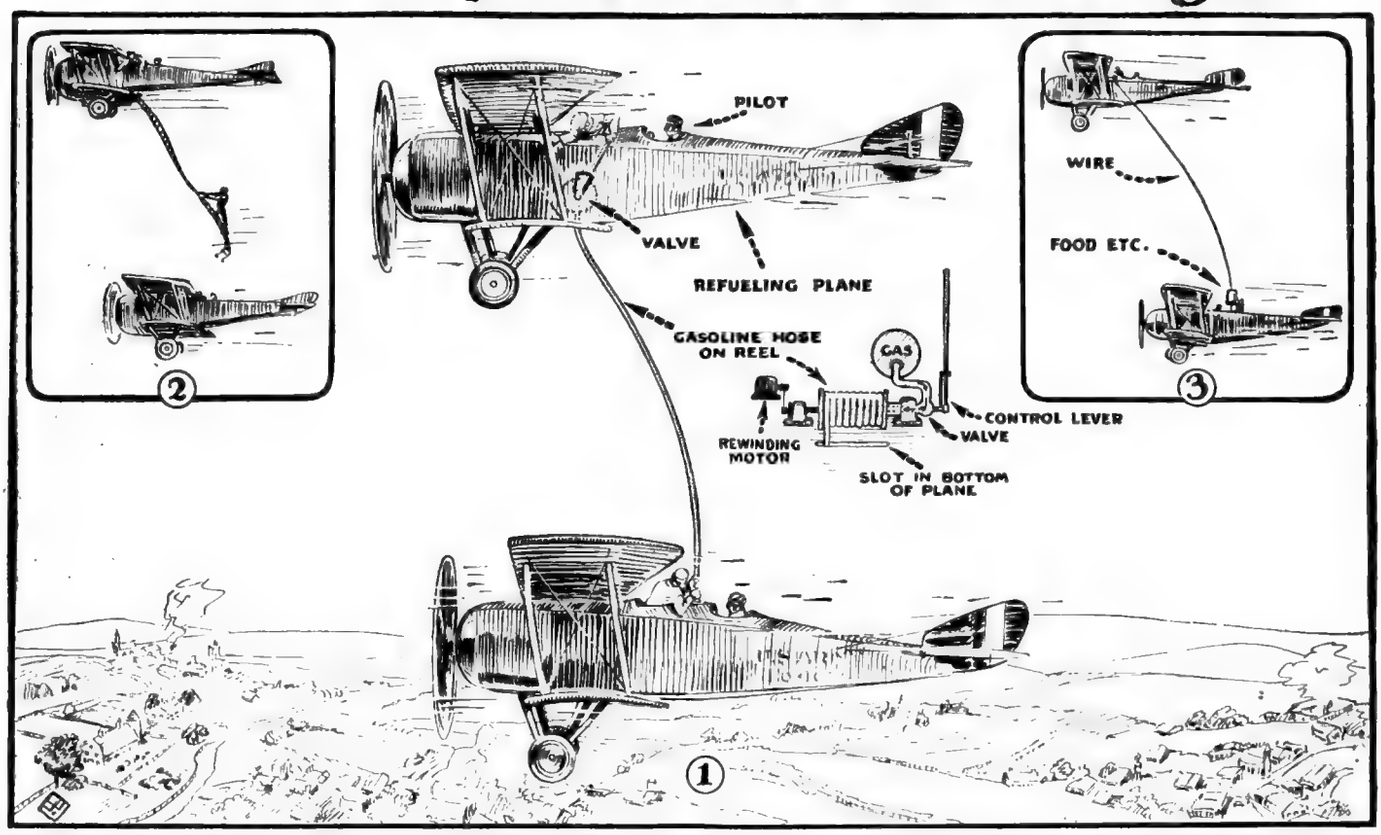
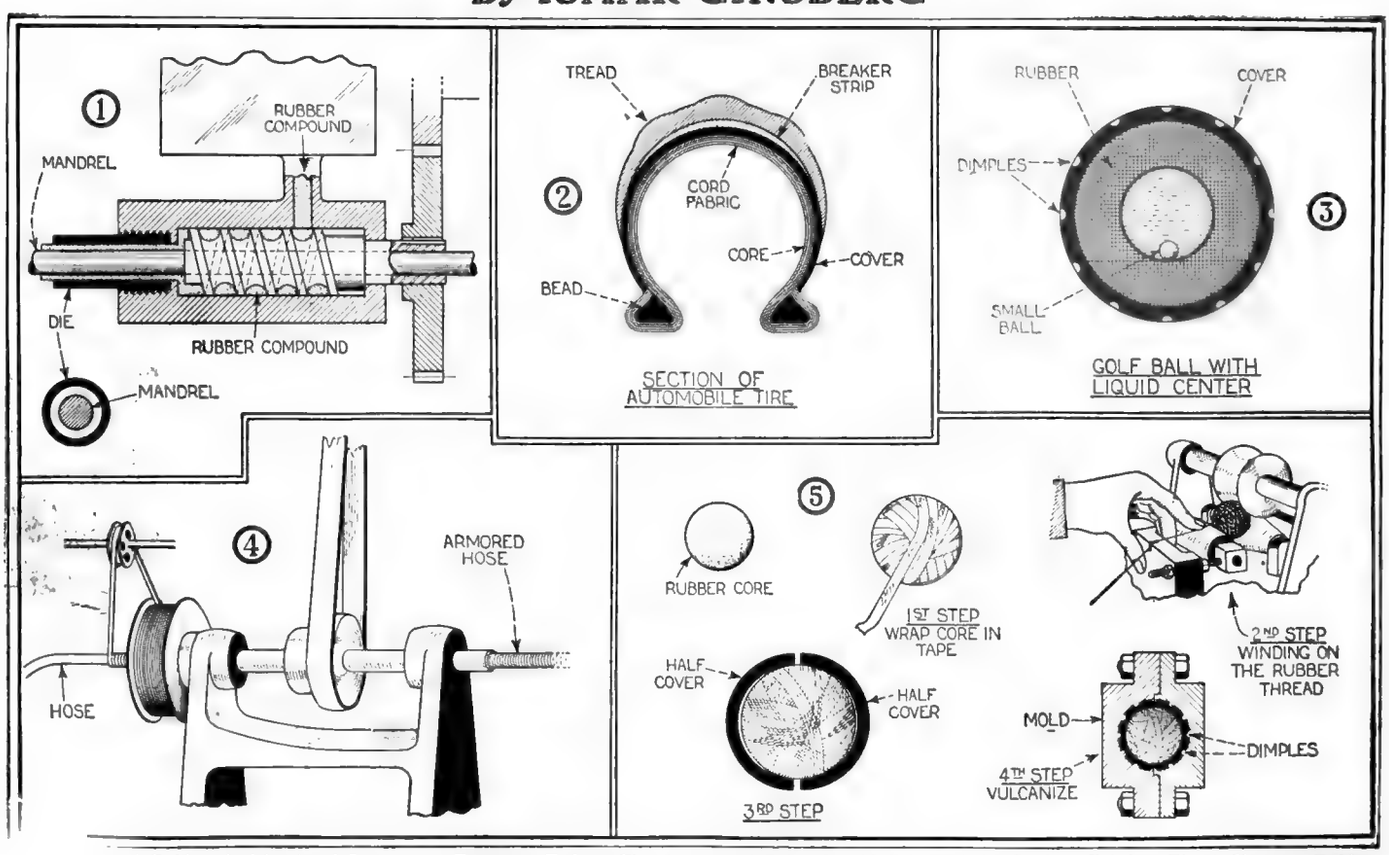
# Army Airplane Refuels In Flight




Refueling Airplanes in Flight Was Demonstrated Successfully by Two Army Flyers Recently. The Method Used in Transferring Gasoline from the Refueling Plane to the Plane Below is Shown in Fig. 1; Both Planes Flew at the Same Speed, of Course. Fig. 2 Shows Another Means of Communication Between Planes in Flight Demonstrated Several Times Already. Fig. 3 Shows Packages Being Sent from One Plane to Another.

# How Rubber Articles Are Made

**By ISMAR GINSBERG**




f Rubber Articles is of Interest to Everyone Today. Fig. 1 Moulded Rubber Compound is Fed Through a Worm Feed ed Out Over a Mandrel to Form Hose or Tubing. Fig. 2 Component Parts of An Automobile Tire, the Rubber Compound Being Moulded Around the Cord or Fabric. Fig. 3 Shows a Rubber Golf Ball Having a Liquid Center. Fig. 4 Shows How Wire Armored Hose is Made; The Hose Passes Through the Axis of Spool Containing Wire. Fig. 5 Shows Successive Stages in Making Golf Ball.

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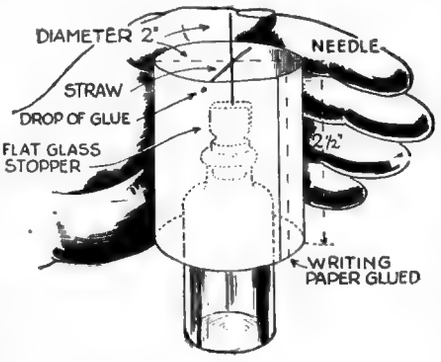
# Sheet Metal Air Propeller

Rudolph Schmidt, eighty years old, has the work of a lifetime bound up in the nautical air propeller shown in the photos above. He began work on it in 1874. Now completed, it will drive a small barge fifteen miles an hour against a stiff river current, it was demonstrated recently.

# $50.00 Prize Contest - Psychic Motor.

AT the right we have what is called a "psychic motor," or a motor to demonstrate what has been termed "animal magnetism." Of course there is no magnetism to it. A magnet does not effect the instrument at all.

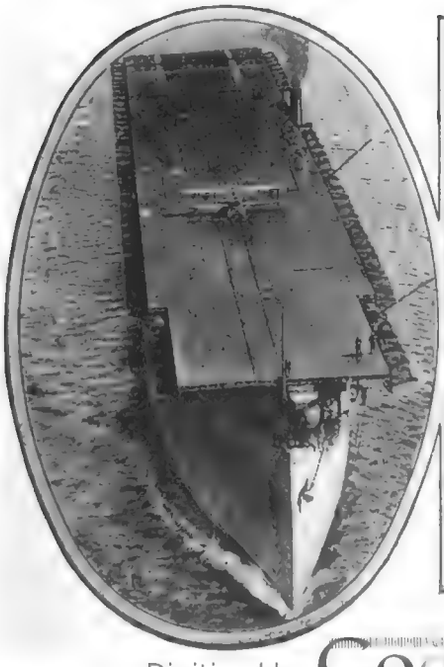
The device shown in the illustration is easily constructed. A piece of writing paper two and one-half inches wide is glued so as to form a cylinder approximately two inches in diameter. Two holes are made diagonally opposite each other and a piece of straw pushed through them. This piece of straw or tooth-pick should extend on either side approximately a quarter of an inch. A minute drop of glue secures it to the cylinder. A needle is passed down through the center of the straw. The entire cylinder is pivoted on the needle point on top of a glass stoppered bottle. When the right hand approaches the cylinder it will be found to rotate in one direction, and when the left hand is held near the cylinder it will rotate in the opposite direction.

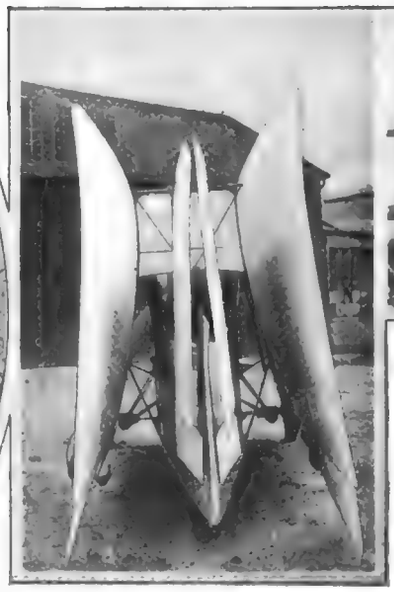


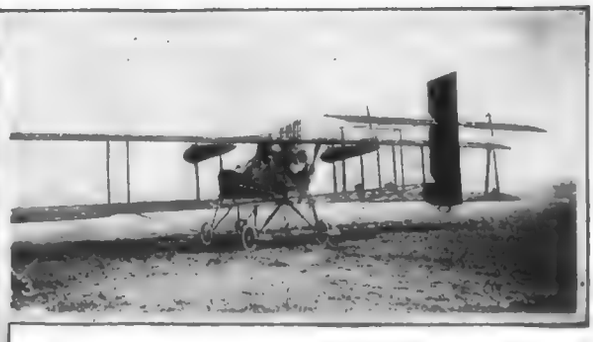

For the best letter explaining why the cylinder rotates, which explanation should be made in pictorial form, as nearly as possible, a first prize of $20.00 will be paid. For the second best an award of $15.00 will be made. For the third, a prize of $10.00 will be given, and for the letter ranking fourth there will be a check for $5.00. Contestants are not limited to the number of answers they may send.

In event of a tie, an identical prize will be given each. This contest closes in New York on January 10th, and all material must be in our hands by that time. Address answers to "Psychic Motor" Editor, care of this magazine.

# The Month's Aeronautical Novelties







STARTED, and steered while in midair, by radio control, the airplane shown above made a successful flight without a human being aboard her recently at the Villesauvage Aerodrome. The engine stops automatically when it lands.

THE "vest-pocket" edition airplane shown in the center photo is the German idea of an airplane flivver. It is made collapsible so that it requires the minimum of space for storage. Envision the commuter folding his plane for the night and storing it in the family garage.

WITH the ever-increasing importance of the airplane in naval warfare—as attested by the recent bombing tests off Newport News—the Navy Department has set engineers to studying more closely types of boat carriers for planes at sea. At the extreme left is shown such a carrier, the U. S. S. Langley.

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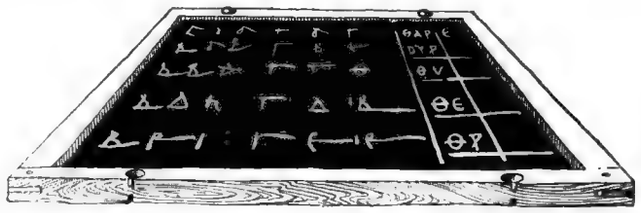
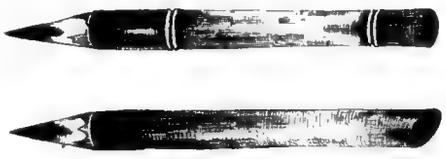
# Office Equipment of Ancient Times

**By Charles B. Bunnell**

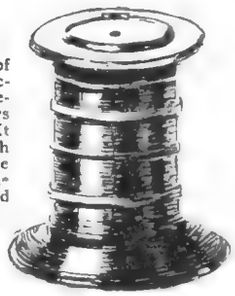
Illustration Above from the British Museum Shows an Ivory Stylus of the Fifth Century B. C., Centuries Before Augustus. The Broad End Was used to Chisel Wax Out, While the Curved Side Burnished It In. The Point Incised the Letters in Wax.



Perspective View of One Single Leaf of a Day-Book Countersunk and Waxed with its Letters Showing Distinctly Although 188 Years Old, (British Museum). Shows One-Half of the Original Table as Inscribed By a Greek.



This Drawing Shows an Unsplit Bamboo Pen (Calamus Chartarius) for Fine Work, and an Unsplit Reed Pen (Calamus Scriptorius) for the Coarse Black Work on Papyrus. And Being Tubular Like the Grape Vine it Absorbed Ink Like a Fountain Pen.



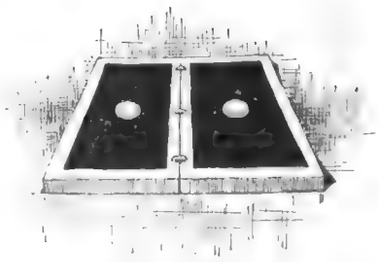
An Ink Stand of the Generally Accepted Roman Design of the Days of Augustus. It Was Inlaid with Six Silver Vine Sprays, While the Hinged Cover Had an Inlaid Edge.

A Perspective View of the Classic Papyrus, Which is Generally 11" x 18" in Size. Note the Columnar Manner (Newspaper Style) of the Most Efficient Papyrus Writing.

3 BRONZE STYLI FROM ROME AND POMPEII - A.D XIV.
A SILVER STYLUS WOUND WITH GOLD WIRE - A.D XIV
A BRONZE STYLUS WOUND WITH SILVER - A.D XIV
A BRONZE SPLIT PEN - ROMAN ERA
B.C. ROMO-EGYPTIAN SPLIT REED PENS FROM BEHNESA, EGYPT.

Above We Show Four Bronze Styluses for Wax Writing, a Split Bronze Pen for Ink Work on Papyrus, Two Split Reed Pens for Ink Work Also, and a Silver Stylus Wound with Gold Wire.

Sketch Shows the Papyrus (Account Books) Rolls Tagged in Their Circular Case or Scrinium.



This Figure Illustrates a Day-Book (diurni) of Two Wooden Leaves, with a Button in the Center of Each to Prevent Rubbing. These Board Leaves Suggest the Modern Book Formation.

## Liquid Air Jack

## Double-Decked One-Man Bus

New Liquid Air Jack Shown at Left Will Lift 30,000 Pounds. It Was Invented by Walter S. Josephson of New York Who is Demonstrating it.

Center and Right Hand Photos Show New One-Man Fifth Avenue Bus. It Is a Double Decked Affair; a Periscope Enables the Driver to See the People on the Upper Deck.

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# Biting Flies That Spread Disease

**By DR. ERNEST BADE**

Right:—The Blood-Sucking, Biting, House Fly, Slightly Smaller Than the Common House Fly, is the Insect Which, According to Recent Investigations, is Responsible for the Transmission of Infantile Paralysis. Is Quite Common in Moist Woodlands and Its Bite is Quite Painful

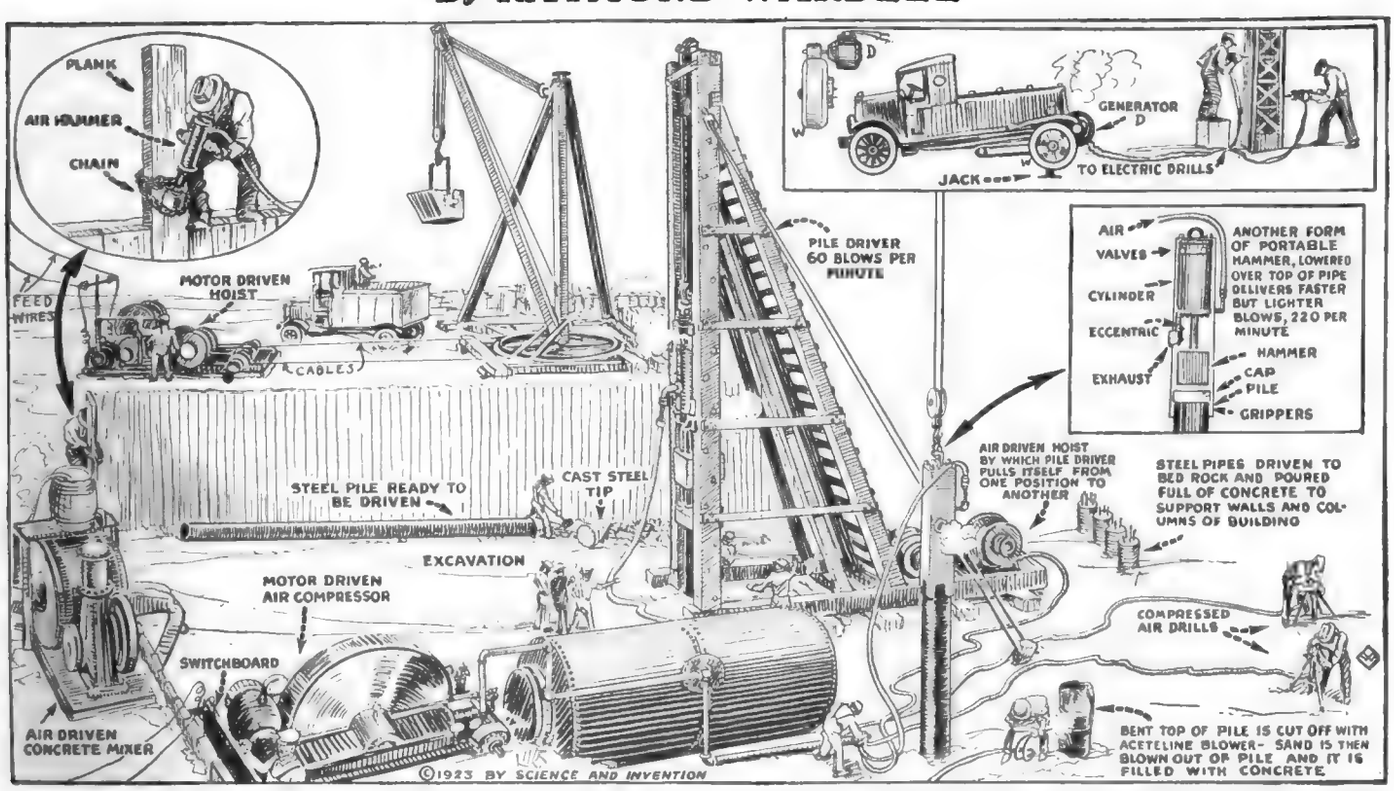
Below:—The Deer Fly, Which is ½ of an Inch in Length, Has Black Marked Wings and is Most Often Met in Woodland Sections and Grassy Meadows, Where a Few Trees Are Found. It Also Has a Painful Bite, But It is Only the Female Which Inflicts the Wound. A Poisonous Substance Is Generally Not Introduced Although Disease Germs May Be Transmitted.

Lower Center Photo Shows the Biting Parts of the Deer Fly's Mouth, the Parts Consisting of a Number of Very Thin and Pointed Hornlike Stilettos, Which Are Arranged in Pairs. After Entering the Skin, the Blood is Pumped from the Veins Into the Mouth and Digestive Tract of the Insect.

Below:—The Beach Fly is a Large Biting, Blood-Sucking Fly Attaining a Length of Nearly ⅝ of an Inch. Its Painful Bite is Only Too Often Felt on the Beaches When the Weather is Hot and Sultry. Only the Female of the Species Bites.

# Compressed Air in Building Construction

**By RAYMOND WARDELL**


PLANK
AIR HAMMER
CHAIN
FEED WIRES
MOTOR DRIVEN HOIST
CABLES
STEEL PILE READY TO BE DRIVEN
CAST STEEL TIP
EXCAVATION
MOTOR DRIVEN AIR COMPRESSOR
SWITCHBOARD
AIR DRIVEN CONCRETE MIXER
GENERATOR
JACK
TO ELECTRIC DRILLS
PILE DRIVER 60 BLOWS PER MINUTE
AIR
VALVES
CYLINDER
ECCENTRIC
EXHAUST
HAMMER
CAP
PILE
GRIPPERS
ANOTHER FORM OF PORTABLE HAMMER, LOWERED OVER TOP OF PIPE DELIVERS FASTER BUT LIGHTER BLOWS, 220 PER MINUTE
AIR DRIVEN HOIST BY WHICH PILE DRIVER PULLS ITSELF FROM ONE POSITION TO ANOTHER
STEEL PIPES DRIVEN TO BED ROCK AND POURED FULL OF CONCRETE TO SUPPORT WALLS AND COLUMNS OF BUILDING
COMPRESSED AIR DRILLS
BENT TOP OF PILE IS CUT OFF WITH ACETELINE BLOWER- SAND IS THEN BLOWN OUT OF PILE AND IT IS FILLED WITH CONCRETE
©1923 BY SCIENCE AND INVENTION

**Compressed Air and Electricity Are Two of the Biggest Factors Involved in Modern Building Construction. Above, We See an Electric Hoist Operating a Derrick and Scoop Shovel, Also Electric Drills Operated from a Dynamo Driven by Friction from the Rear Truck Wheel, the Truck Being Jacked Up. Compressed Air Operates the Concrete Mixer Shown in the Lower Part of the Scene, as Well as the Pile Driver and the Rock Drills.**

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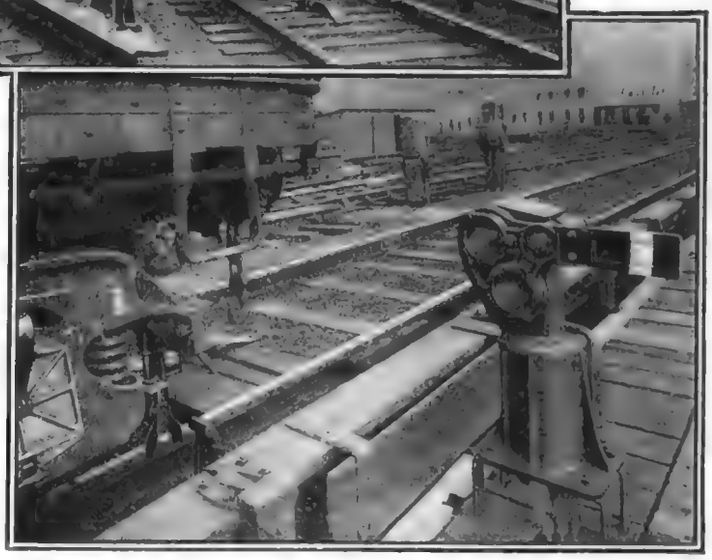
# Compressed Air in Subway Operation

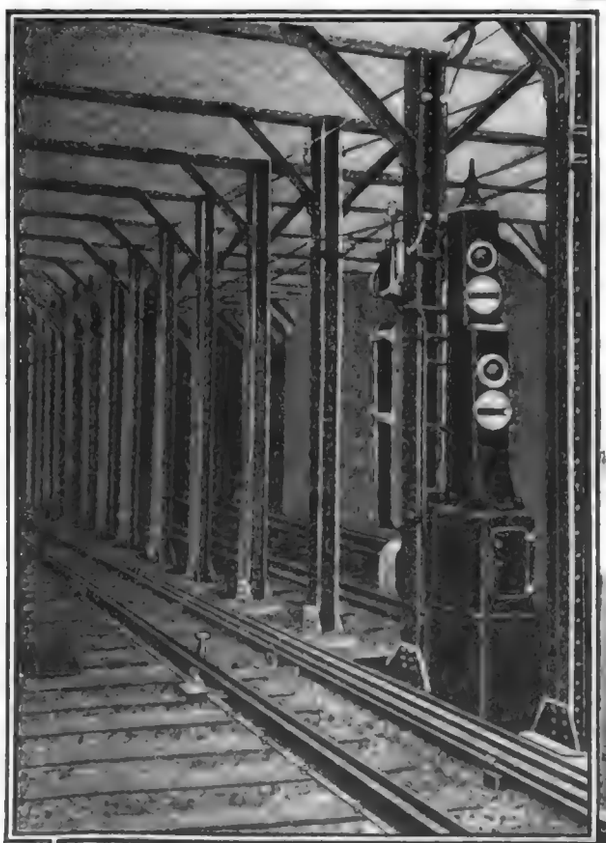
**Top Illustration in Lower Group—Front View of a Typical Block Signal in the Subway, Showing Lights, Position Indicators, Instrument Case Upon the Post in Advance, and Also the Track Train Stop.**

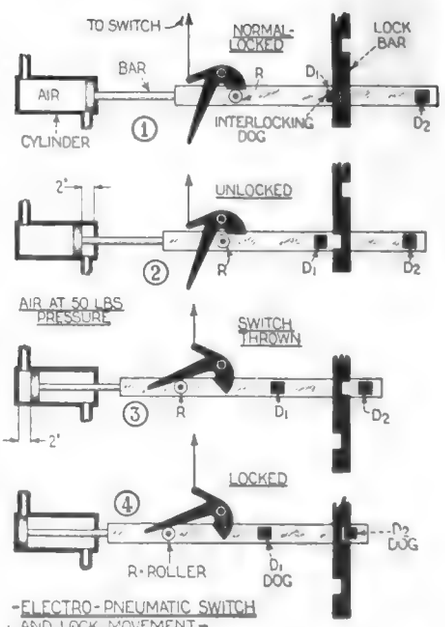
**Lower Illustration—Mechanism for Operation of the Pneumatic Track Train Stop, Showing Trigger Elevated to "Stop" Position.**

**Should a Signal Which Shows "Stop" Be Disregarded by the Motorman, His Train Will Be Automatically Stopped by the Action of the Trip in the Track Which is Shown in the Illustrations. This Trip Automatically Engages an Arm on the Train Which Shuts Off the Power and Applies the Brakes.—By R. H. Tingley.**

**Illustration at Left—Automatic Stop Mechanism in Track at Van Cortlandt Park. Lower Illustration—Dwarf signal and Automatic Train Stop—Electro-pneumatic Interlocking, at 228th Street Yard of the Interborough Rapid Transit, N. Y. City.**








**Simplified Working Diagram of the Electro-pneumatic Interlocking Subway Switch. Switches Are Pneumatically Unlocked and Again Locked by This Device. Fig. 1—Switch in Normal Position. Fig. 2—Switch Bar Unlocked by Movement of Air Piston. Fig. 3—Switch Thrown to Reverse Position. Fig. 4—Final Movement With Switch Bar Locked in Reversed Position by D-2.**

## Want More Information?

IF you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION we shall be glad to give you any other data we have at our command if you will send 50c. for such special data. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Send stamped and self-addressed envelope together with 50c. remittance in stamps, money order or certified check.

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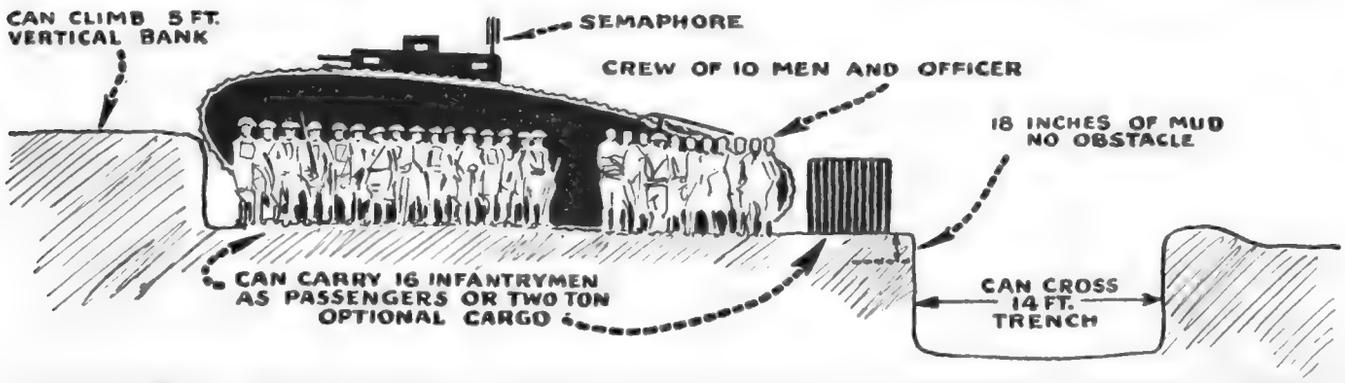
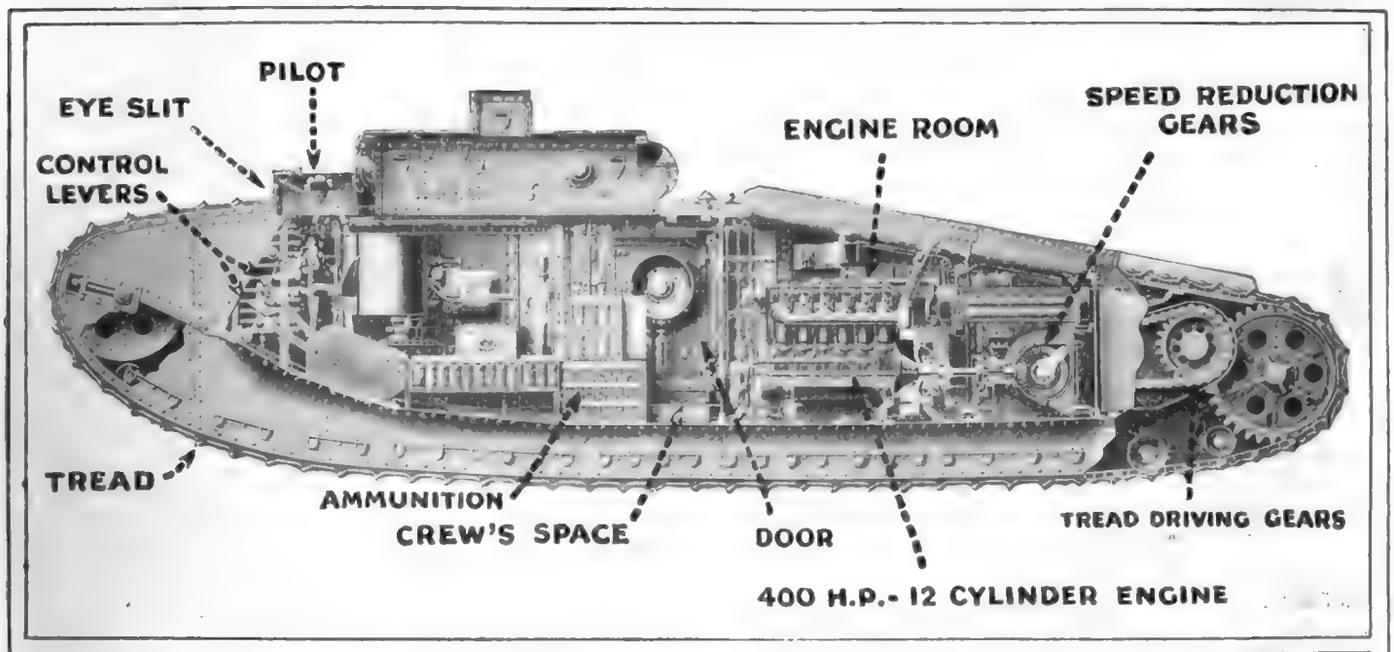
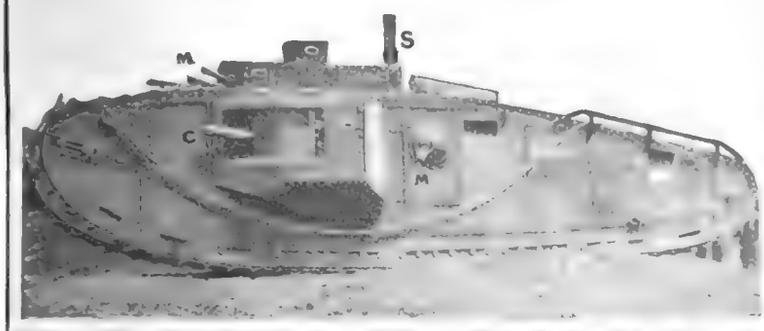
# Monster Army Tank Destroyer

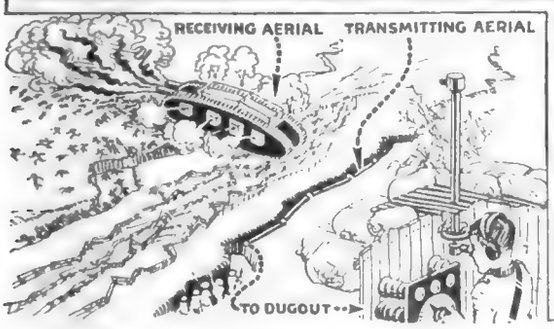
**By S. D. ROCKENBACH, Commandant U. S. Army Tank School**


CAN CLIMB 5 FT. VERTICAL BANK
SEMAPHORE
CREW OF 10 MEN AND OFFICER
18 INCHES OF MUD NO OBSTACLE
CAN CARRY 16 INFANTRYMEN AS PASSENGERS OR TWO TON OPTIONAL CARGO
CAN CROSS 14 FT. TRENCH




Ordinary Houses and Trees 12 Inches in Diameter Are Knocked Down by the New Mark VIII Tank. Its Path is Readily Followed by the Light Tanks and Infantry and Can Easily Be Made Usable by Supply Vehicles. The Engine is a 400 H.P., 12 Cylinder Liberty Type Geared Down. Lower Left Picture—Radio Controlled Tank—of To-Morrow.



**The General Specifications for the Mark VIII Were as Follows: Weight: 35 Tons. Length: 34 Feet, 2½ Inches. Width: 12 Feet (With Sponsons Out, 8 Ft. 8 In. Folded). Height: 10 Feet, 3 Inches. Armor: Proof Against All Small Arm Bullets Including Armor Piercing. Armament: 5 Machine Guns of Which 4 Can Be Fired at Once. 2 Six-Pounders (2.24" Bore). Speed: Maximum, 6 Miles Per Hour. Power. 10 H.P. Per Ton of Weight. Trench Crossing Ability: 14 Feet. Ability To Climb Vertical Bank: 5 Feet. Flotation: 4.5 Pounds Per Square Inch—Any Ground That Will Support a Man. Communication: Every Tank Carries Two Pigeons and Signal Flags. Every 16th Tank Has a Radio Set. Every Company Has Messengers. Cargo: 16 Infantry or Machine Gunners in Addition to Crew, or Cargo of Two Tons. Wire: No Obstacle. Radius of Action on One Fill: 50 Miles. Mud: 18 Inches of Mud No Obstacle. Obstacles Readily Overcome: Forest, Boulders, Shelled Areas Soaked With Water and T**

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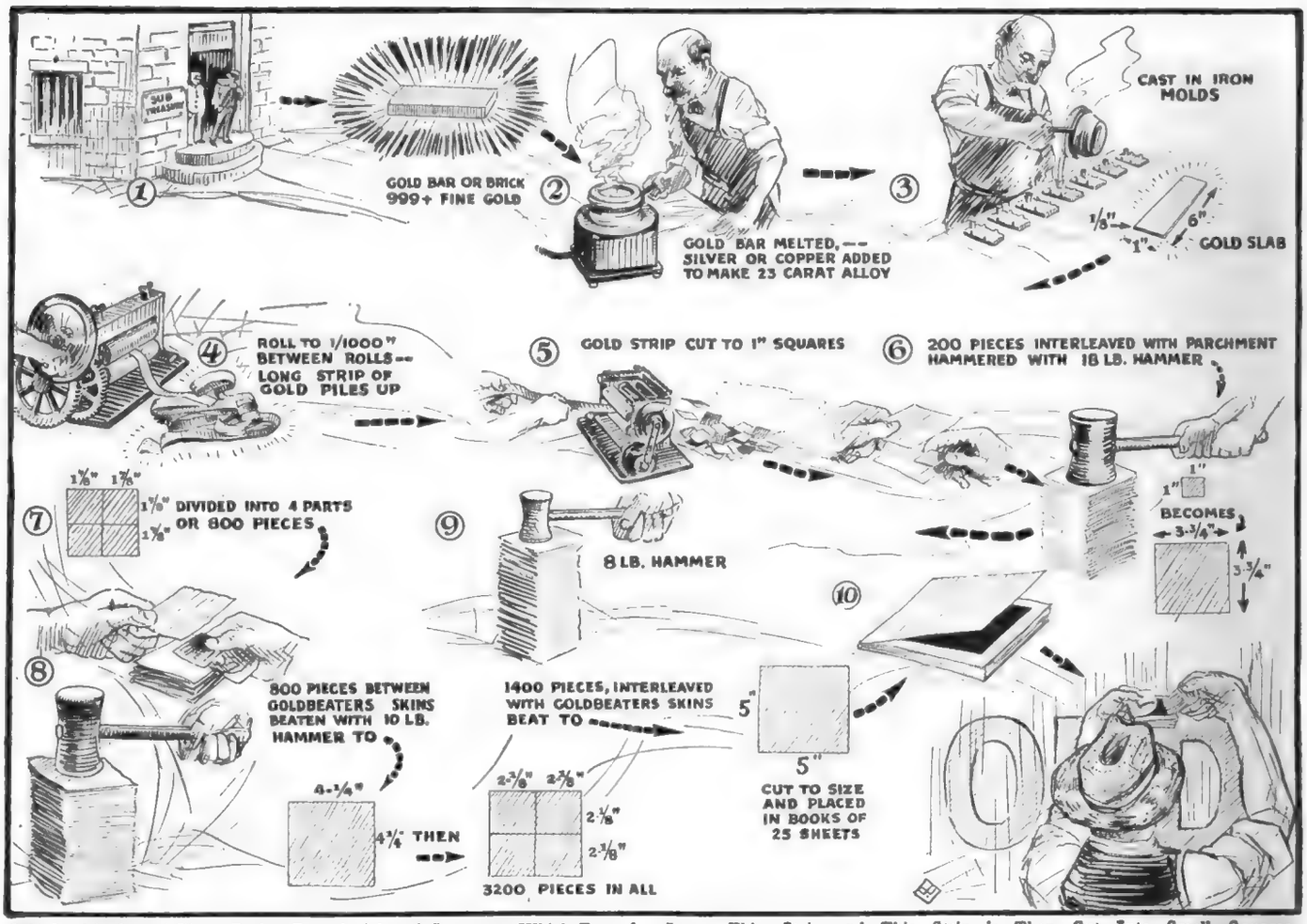
# Gold Leaf—How It Is Made

**By ISMAR GINSBERG**




Gold Leaf is One of Those Rather Rare Articles of Commerce Which Few of Us Have Occasion to Use. The Successive Stages Followed in the Making of Gold Leaf Are Illustrated Above. A Bar of Pure Gold is Melted and an Appropriate Alloy Added. This Is Then Rolled Into a Long, Thin Strip and This Strip is Then Cut Into Small Squares. By Repeatedly Hammering the Gold Leaf, Placed Between Gold-Beaters' Skins (Made from the Large Intestines of an Ox), It is Finally Cut Into Squares and Placed Between Paper Leaves in Book Form.

## Typewriting by Wire

nmunicating Electric Typewriter Invented By Dr. George A. Cardwell of Yonkers, New tation With Such a Typewriter May Communicate By Wire With a Similar Station.

## Drawing Made Easy

By Means of This "Patient Teacher" Drawing Machine Together With a Pantograph Apparatus Also Supplied by Its Inventor, Art Students Can Make Rapid Headway. This Device Can Be Used For Checking Up Free-Hand Drawings Once They Have Been Executed.

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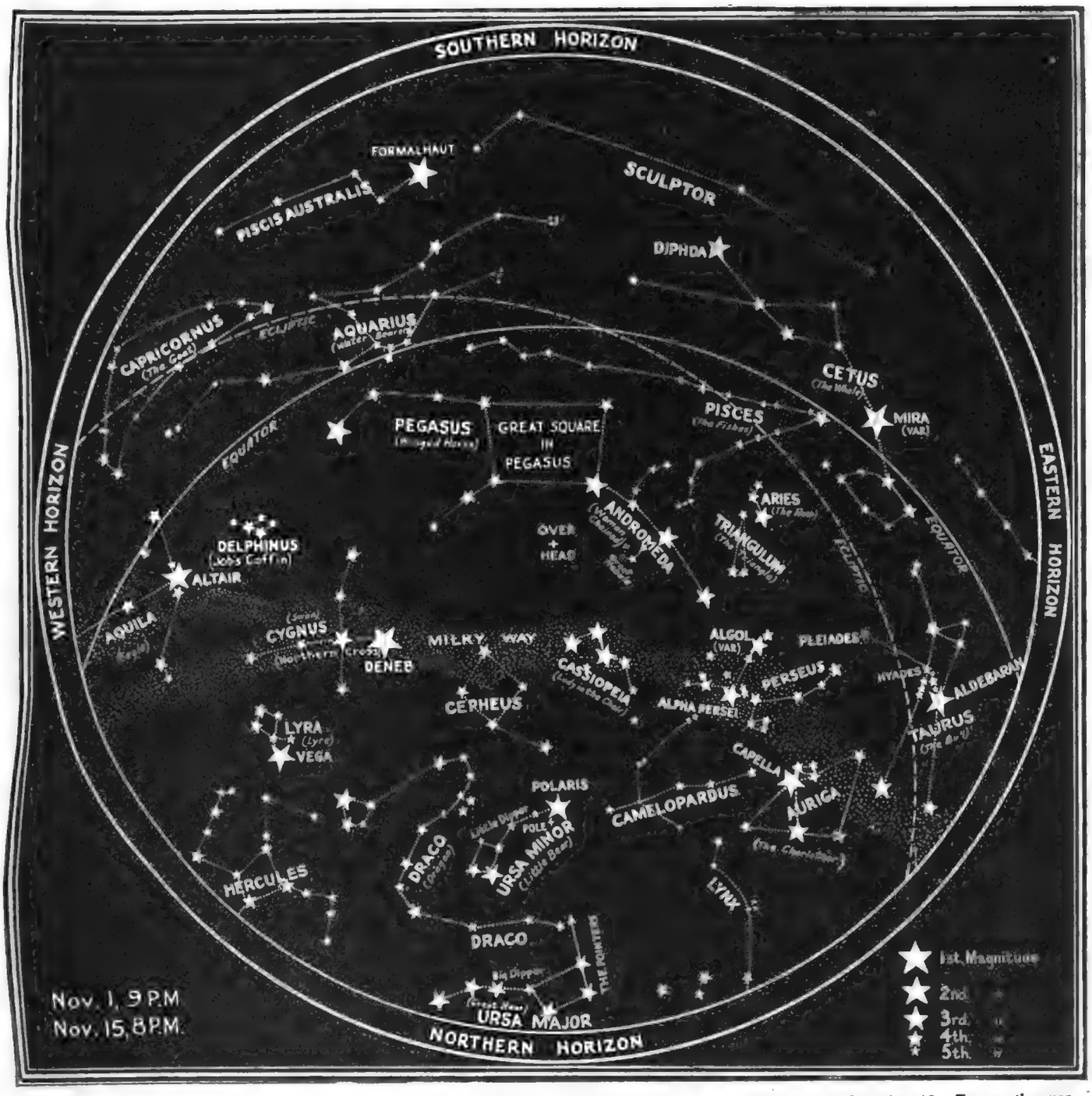
# Popular Astronomy

**By ISABEL M. LEWIS, M.A.**

OF THE U. S. NAVAL OBSERVATORY




**Above is the map of the heavens for November. The location of the stars shown will coincide exactly with their positions in the heavens at nine P. M., November 1, or eight P. M., November 15. To use the map, hold over the head with the top of the map to the south.**

## CHART OF THE HEAVENS FOR NOVEMBER

THE last of the summer groups, Hercules, Lyra and Aquila are approaching the western horizon. In the east and northeast are appearing the vanguard of the brilliant constellations of winter, Taurus the Bull, with its famous groups of the Hyades and the Pleiades, and Auriga, the Charioteer with its beautiful Capella.

Directly on the meridian at this time and to the south of the zenith is the Great Square in Pegasus and adjoining it on the east is Andromeda.

In the north we find Cassiopeia and Cepheus close to the meridian and in the west the Northern Cross in Cygnus is still conspicuously in view. Cetus, the Sea-monster, now rears his huge form above the eastern horizon and its second magnitude star Diphda, or Beta Ceti, is the brightest star in this part of the heavens. It will be recognized by the fact that it stands in an isolated position far over to the southeast. In the southwest, also in solitary splendor, is the beautiful Fomalhaut in the constellation of the Southern Fish, Piscis Australis.

In Cetus we have one of the mysteries of the heavens called Mira. In a period of about eleven months it changes very irregularly in brightness from a telescopic star of the tenth magnitude to a star of the second magnitude. It is usually visible to the naked eye for less than two months. Though Mira has been observed through more than three hundred of its cycles of light changes the cause of its peculiar and irregular variations still remain a mystery.

This month we also have in fine view for observation another of the mysteries of the heavens, the Great Nebula in Andromeda. It will be easily found in the position indicated as a faint, cloudy patch of light.

The Andromeda Nebula belongs to the large class of spiral nebula whose distances are unknown.

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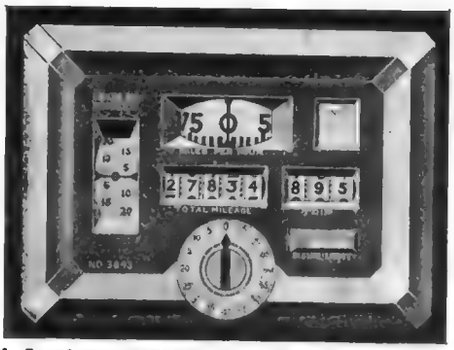
# Aids To The Motorist

## SPEEDOMETER



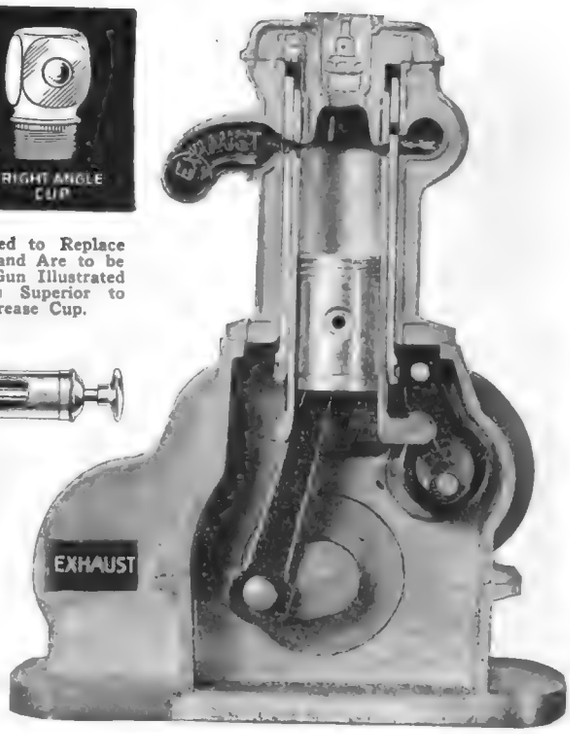
A Speedometer Which Records Speed, Trip Mileage, Season Mileage, and Grade on Which the Car is Traveling. A Speed Signal Light and an Ignition Lock Are Included in the Instrument.

## OILING SYSTEM

The Oil Cups Above Are Designed to Replace the Standard Cups Used on Cars and Are to be Used with the High-Pressure Oil Gun Illustrated Below. This System of Oiling is Superior to Those Using the Old Style Grease Cup.

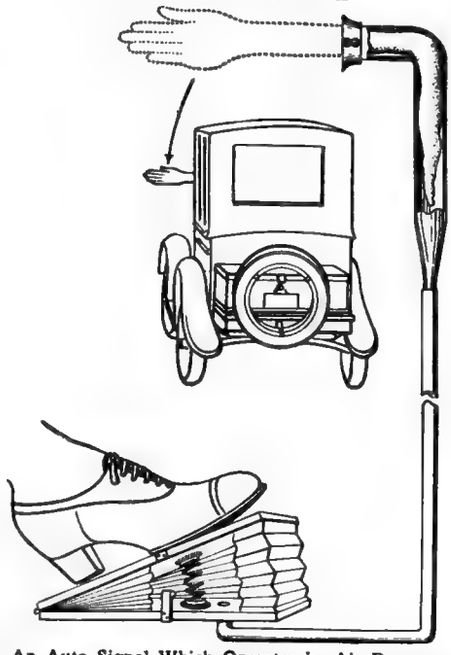
The Oil Gun Illustrated Above, Forces Oil Under High Pressure Into Cups Illustrated at the Head of This Column. The Force Used Presses the Oil Into All Parts Which Makes for More Thorough Lubrication. This Gun Produces a Pressure of 2000 Pounds to the Square Inch at the Nozzle.

## ENGINE MODEL



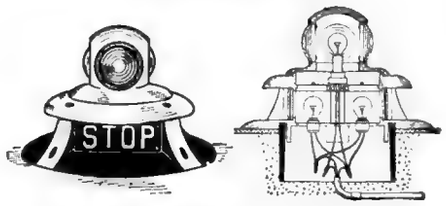

At the Right is Illustrated a Model of an Engine of the Knight or Sleeve Valve Type. This Model is Only 3½ Inches Wide by 4 Inches High. However, by Turning the Motor by Hand, the Pistons and Sleeves Operate Exactly as They Do in the Real Engine. This Was Designed for Use as a Salesman's Model.

## TURNING SIGNAL



An Auto Signal Which Operates by Air Pressure, Furnished by Pressing a Small Bellows with the Foot. This Causes the Rubber Hand to Extend as Shown.

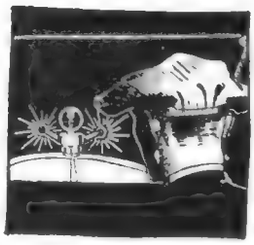
## TRAFFIC SIGNAL



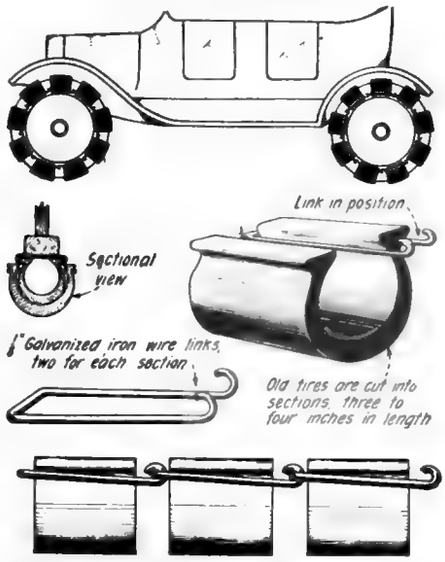

A Unique Traffic Signal Which Stands Only 8½ Inches Above the Street Level and is Designed to Automatically Regulate Traffic at Crossings.

## MOTO-METER LIGHT

At the Right: A Combination of a Moto-meter and Luminous Radiator Cap. Two Small Lights Serve as Emergency Driving Lights and Also to Illuminate the Moto-meter When Driving at Night.



## TIRE PROTECTOR


Link in position
Sectional view
Galvanized iron wire links, two for each section
Old tires are cut into sections, three to four inches in length

This Tire Protector Which is Designed to Be Placed Over Standard Pneumatic Tires. They Consist of Sections of Old Tires About 3 or 4 Inches Long, Held Together by Means of Galvanized Iron Wire Links as Shown.

## PISTON GAGE

By Means of the Device Illustrated Above it is Possible to [illegible]sure the Outside Diameters of Objects S[illegible]ns, Directly in Thousandths of an I[illegible]e is Nothing More Than a Fle[illegible] But It Will Measure Diame[illegible] 1-16ths Inches Very Accurately.

## TIRE REMOVER

By Means of the New Device Illustrated Above it is Possible to Change Tires in a Very Short Space of Time. The Device is Applicable to Any Type of Standard Rim.

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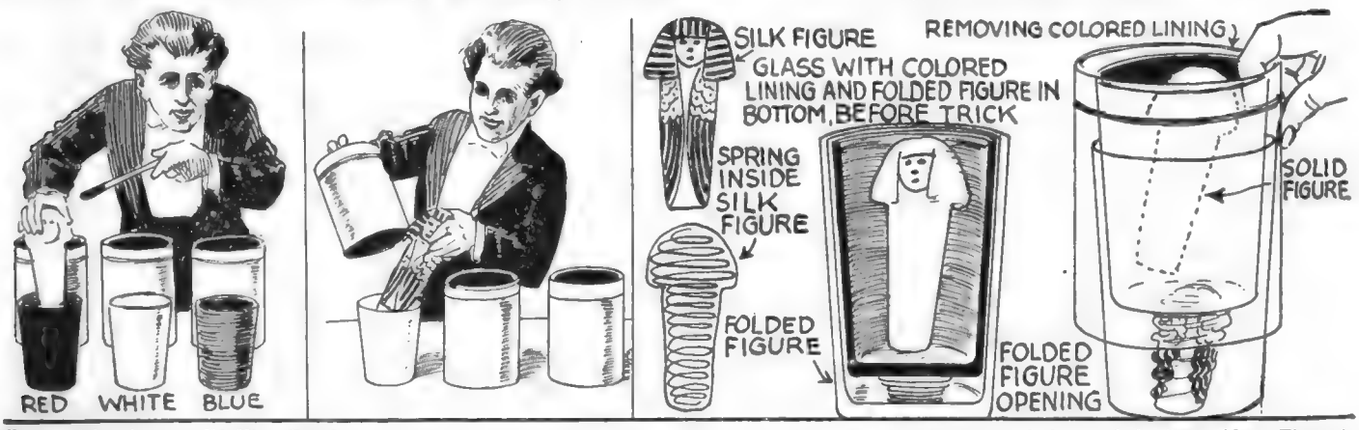
# Magic for Everybody

## By PROF. JOSEPH DUNNINGER

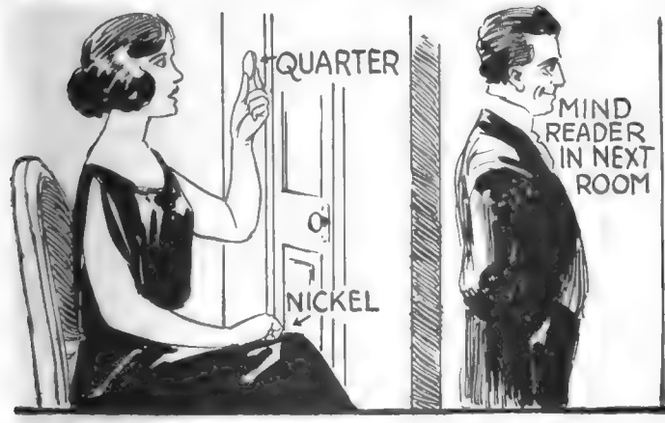
NUMBER 8 OF A SERIES.

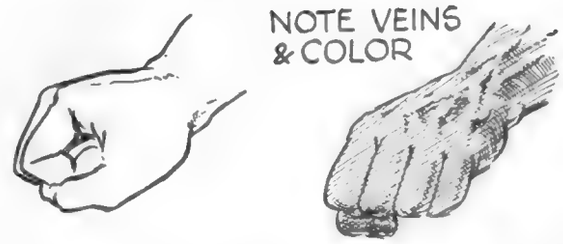
The magician pours liquid from the bottle, then wraps it in newspaper and tears it in two. A rabbit jumps out on the table. The Professor throws the crumpled wrapper off stage. It's all very simple when the apparatus used is explained. The shank of the bottle is made of lacquered paper. A false top is made of light metal laquered the same color. The top contains the liquid; the bottom the rabbit.




The magician has a solid King Tut figure examined. He then places it in a red colored glass, puts a paper cover over it and—Behold—the glass is clear and there is a red King Tut figure in it. The red figure is then placed in a blue glass—the glass becomes colorless and the figure blue. The color of the glass is imparted by a false celluloid tumbler inside. The colored figures are of cloth with a spring inside.

Professor hands out a deck of cards to be examined, also a billiard ball. He then shuffles them, balances the ball on top and it rolls from side to side. Wonderful, his sense of equilibrium. But, look closely, the ball has a small hole and the professor depends on a small spring wire to hold the ball.




Two coins are held in the hands resting on the knees. The professor leaves the room. The observer is asked to hold one of the coins up in front of his eyes for a count of twenty. The Professor returns to the room and tells which coin was observed. While holding the coins on the knees the blood rushes to the hands and colors them slightly. In the hand that holds the coin in front of the eyes the blood recedes and leaves it lighter th[illegible] Try it.

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# Popular Scientific Errors

## By RAYMOND B. WAILES

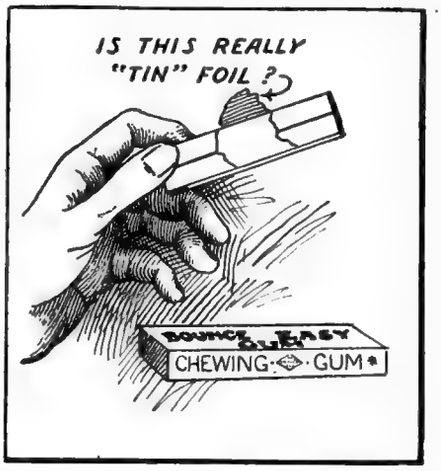
One of the most common articles which bears a name that is scientifically incorrect is sealing wax. It contains no wax at all but is a compound of shellac and turpentine with coloring matter added. In some of the cheaper grades rosin is substituted for some of the shellac.

A very small amount of the so-called waxed paper is really waxed. The "glassine" papers, the clear and brittle varieties, are made by over-cooking the paper pulp while it is being prepared for the rolls in the paper mills. Good waxed papers are costly.

German Silver contains no silver at all. It is an alloy consisting of approximately eighteen per cent nickel and the remainder copper and zinc. The United States five cent piece called a nickel, is made of fifteen per cent nickel and eighty-five per cent copper.

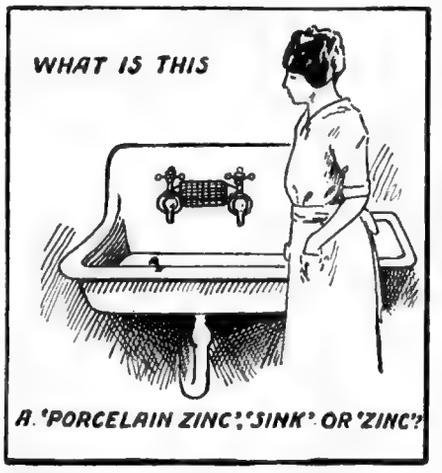
The snake has "no stinger." The forked projection from its mouth is simply its tongue. The snake's poison is not injected into the bite through the tongue. There are special glands over its upper teeth that force the poison through the teeth and into the wound.

The natural composition of the tobacco plant contains a goodly percentage of potassium and nitrate in various forms. Any saltpetre in cigarettes is the natural product put there by Mother Nature. Bits of stems that are left in the tobacco often cause "fire-spitting."

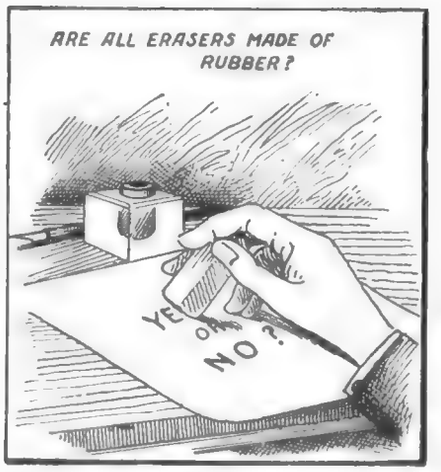



Tin foil is very little used for wrapping on account of its cost. Lead foil is substituted. Lead foil always has a waxed paper attached to its back when it is used in wrapping foods. Real tinfoil is more brittle than leadfoil and crinkles when bent.

Ice blankets do save ice by keeping it from absorbing the heat in the surrounding air. The use of such a blanket in an ice-box reduces its efficiency because it does not allow the ice to cool the objects put in the box. Ice cools surroundings only when it melts.




Solid, or real, "Zincs" are seldom used for laundry and wash basins. Iron "sinks" are often coated with it as in galvanized ware. More often they are simply enameled. Ask the plumber—he will tell you "but, yes, we have no zincs in the kitchen."




Some of the so-called "ink erasers" contain rubber. The more common variety, however, sometimes known as "soap erasers" are made by specially treating the products of corn oil. The product is then sulphonated. Most of the popular art-gums are made by this process.

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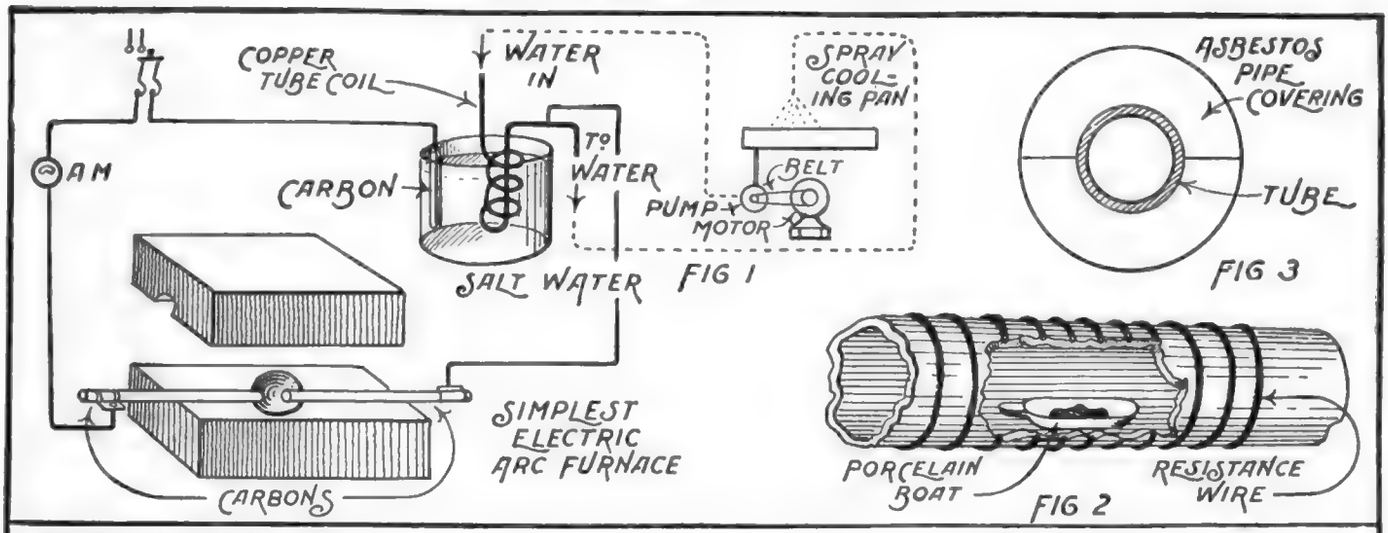
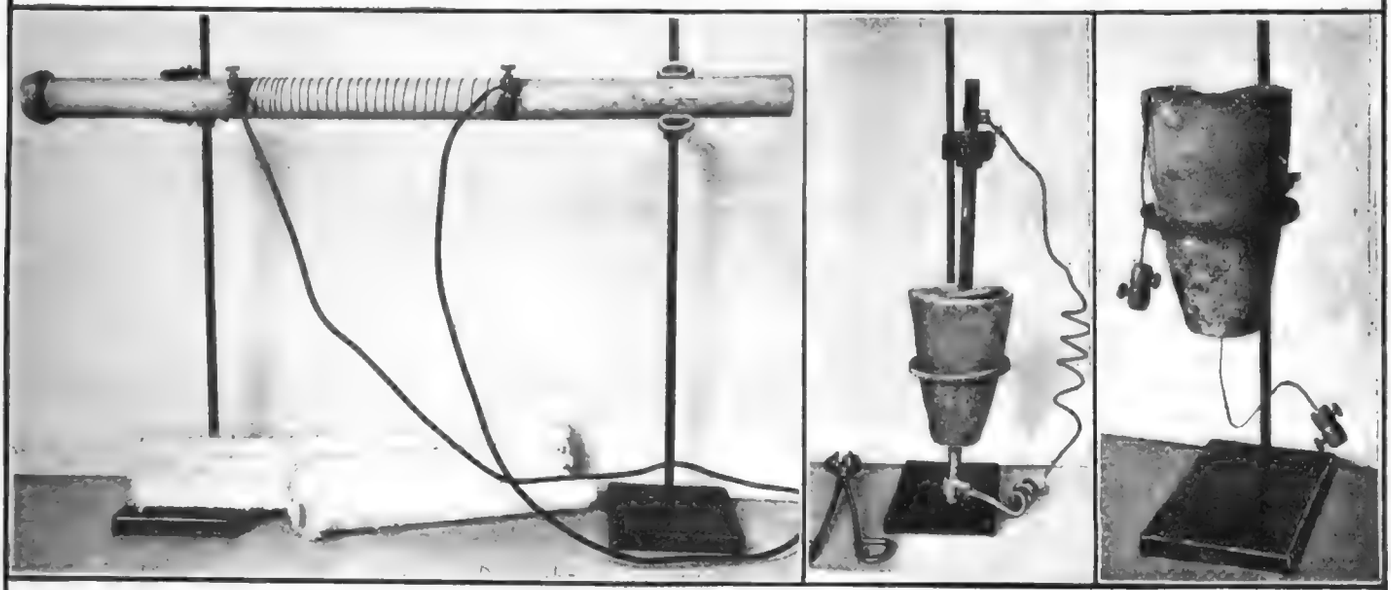
# Experimental Electro-Chemistry

By RAYMOND B. WAILES

## SOME EASILY MADE ELECTRIC FURNACES




The structural details of two very simple electric furnaces are shown in the sketches above. Two fire bricks hollowed to take carbon electrodes and a water cooled rheostat are all that is necessary for its construction. In some cases the rheostat may be unnecessary and the furnace connected directly to the lighting mains. The other furnace is of the tube variety. It consists of a porcelain insulator of the lead-in type wound with high melting point resistance wire. The tube and resistance are covered with asbestos. A porcelain boat holds the substance.



The photo to the left above shows the tube furnace as it stands ready to receive the outside coating of asbestos. At the center is shown a furnace of the arc type installed in a crucible. A lid is made fast around the top carbon that fits over the top of the receptacle when the arc is drawn. The whole is supported on a ring stand. At the extreme right is shown another furnace of the resistance type. It will lend itself very well to ignition work. A crucible is placed inside the large container and surrounded with the resistance unit.

# MACHINE FOR PAINTING ROAD SAFETY-LINES

The machine shown above is being used extensively by the highway commission of California to paint white lines in the center of its paved highways.

The paint flows down the hose in front of one spreading brush; a second brush behind the first evens up the line. W. Geiger.

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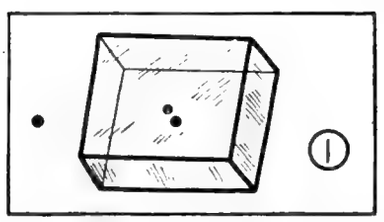
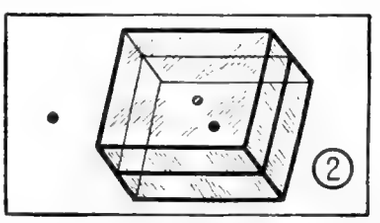
# Experiments With Spar Crystals

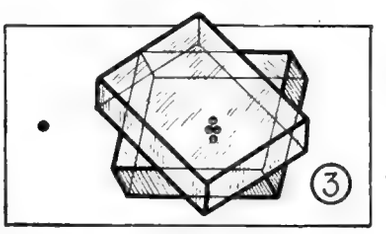
By O. IVAN LEE

Iceland spar crystals can be obtained from scientific supply houses.

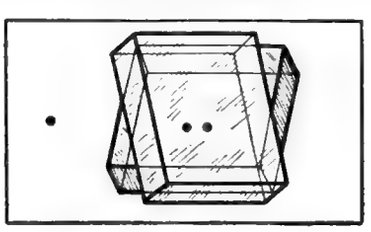
TRY YOUR CRYSTAL ON THESE

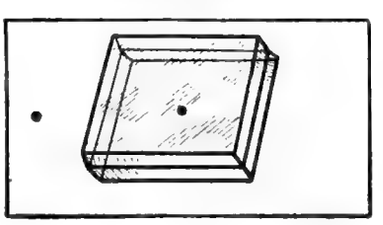


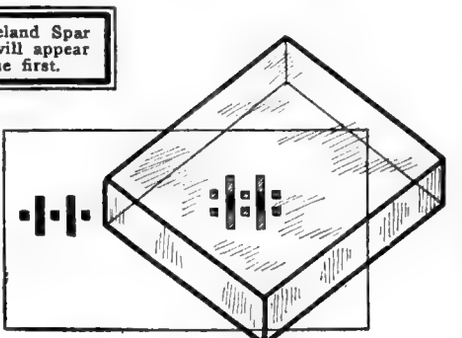



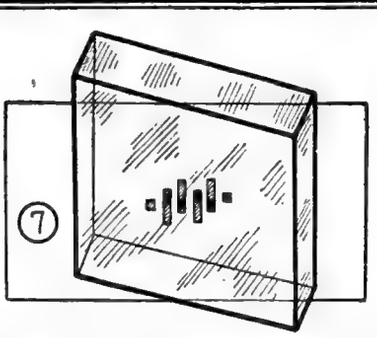

Very interesting experiments showing the double refraction of light can be performed with Iceland Spar crystals or cleavages. In Fig. 1, if the crystal is placed over a black dot on a card the dot will appear double. If the crystal is rotated with the dot as a center the second dot will turn round the first.



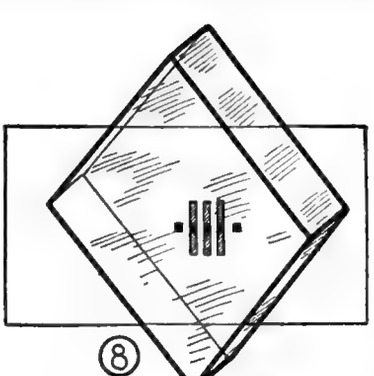



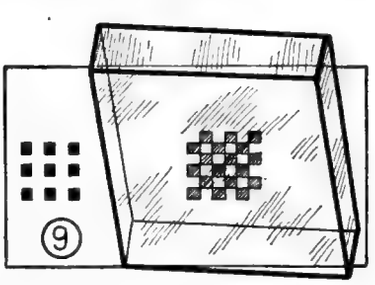




The second or shadow dot always lies in the direction of the crystal's slope. Also, its distance from the first dot is directly proportional to the thickness of the crystal, hence in Fig. 2 where two crystals are used the dot is twice as far away. In Fig. 3 when the top crystal is at an angle of 45 degrees with the bottom one, four dots appear. On rotating the crystal further, 90 degrees, in the same direction only two dots will be visible. (4) Continuing to 180 degrees total, only one dot is visible, the second crystal counteracting the refraction of the first (5). In Fig. 6 another pattern is taken. The single dots become double and the lines become shaded when they are viewed through the crystal.

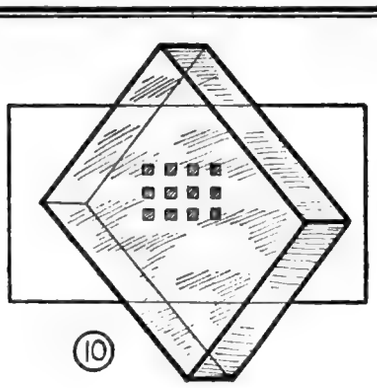


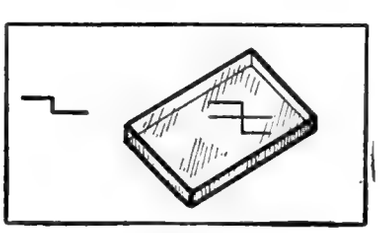

Above, the same design is subjected to the crystal set at a different angle. One of the dots disappears and a fourth line is added in its stead. The lines are shaded.

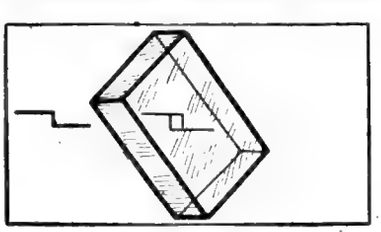



The design used in Fig. 6 is used in Fig. 8. When nine squares, as shown in Fig. 9 are used, the resultant diagram is a checkerboard. The squares should be made equidistant.




For the best effect in using the squares pattern, the diagonal of the squares should equal the displacement of the crystal used. At the 45 degree angle as in Fig. 10 the nine squares become twelve. When the broken line in Fig. 11 goes under the crystal the figure is an incomplete swastika. At the 90 degree angle it becomes a sort of socket wrench. Other designs for the use of the experimenter are printed at the extreme top of the drawings.

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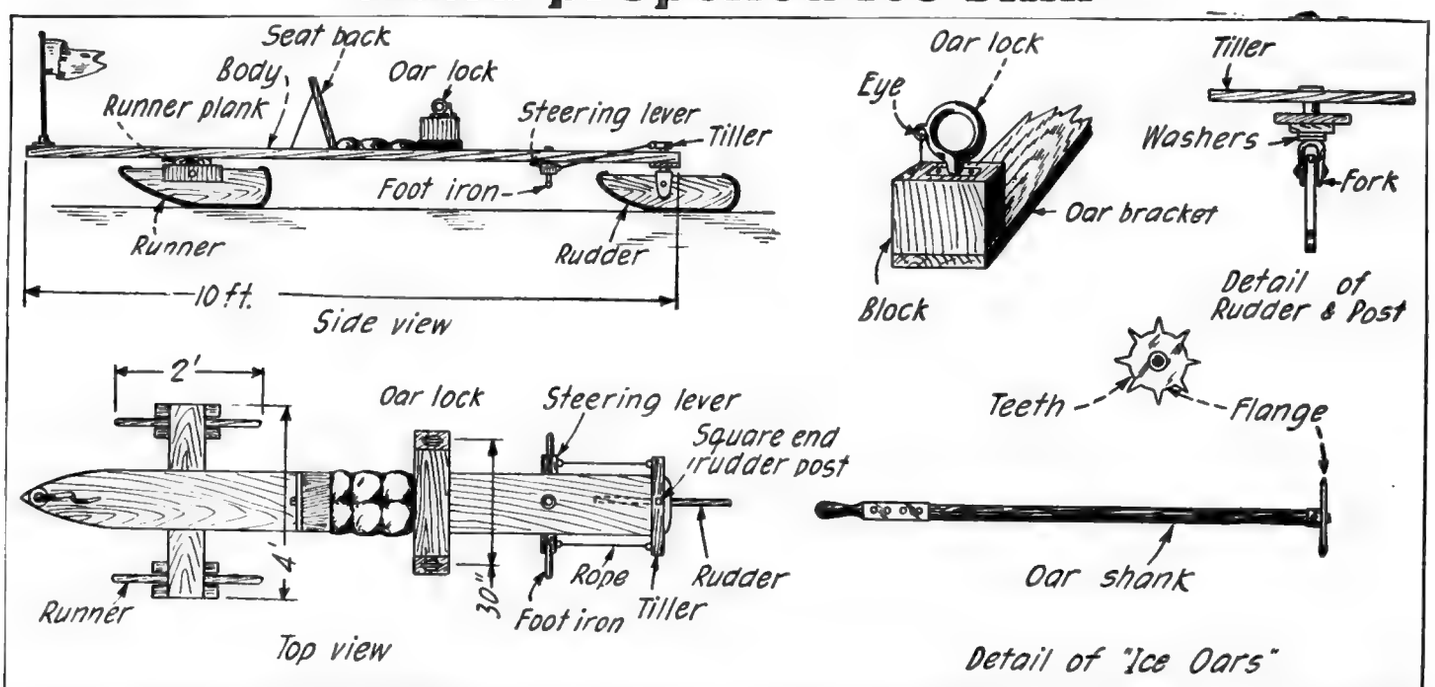
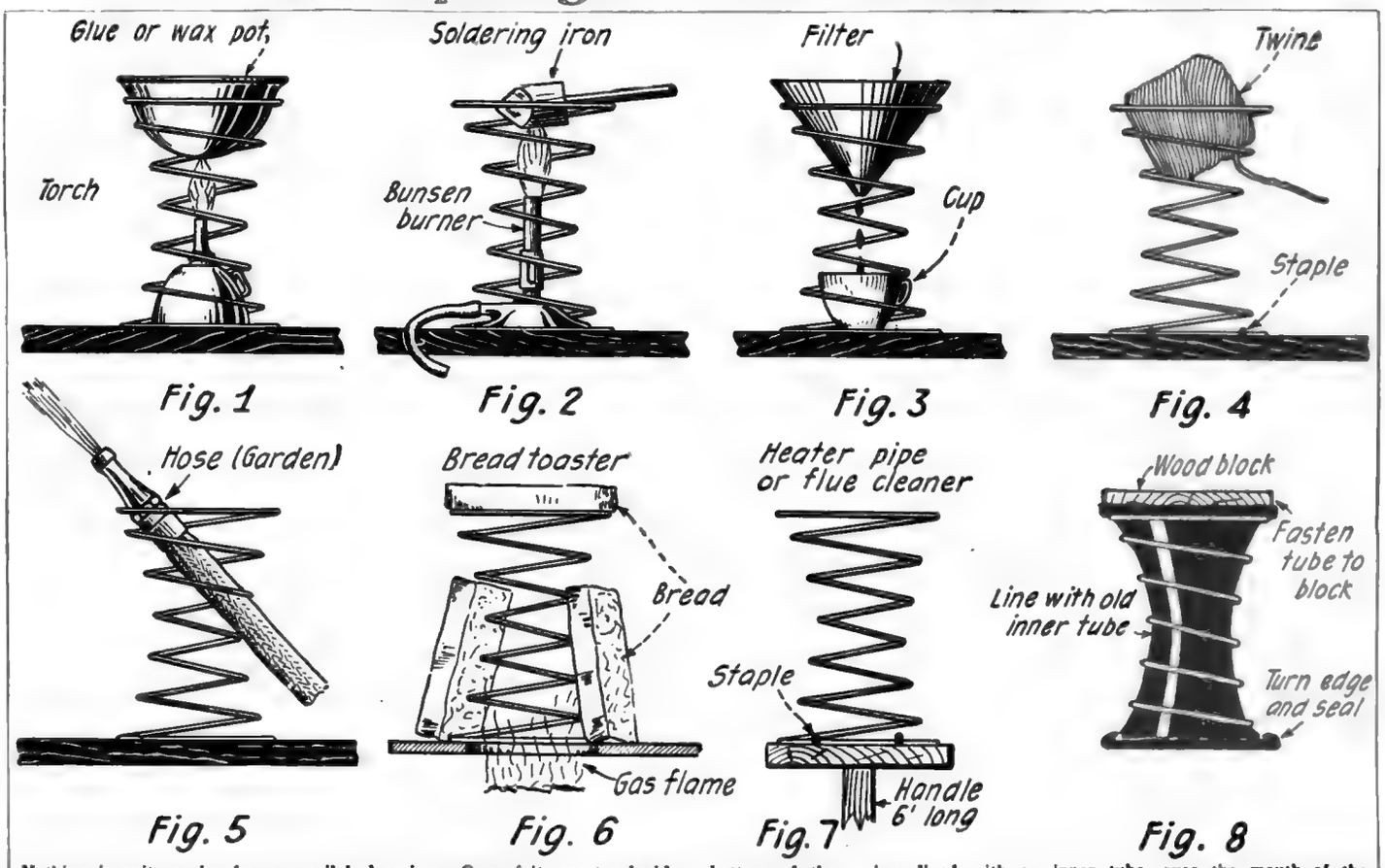
# THE CONSTRUCTOR

## Hand-propelled Ice Skiff




The above shown skiff is very similar in design to the regular ice boats. The principal difference is that it is hand rowed. The "oars" are of wood with a spiked wheel at the end that grips the ice. All wood construction should be of oak or hickory. —L. B. Robbins

## Coil Bed Spring as General Handy-man




Nothing is quite so handy as a coil bed spring. One of its most valuable uses is as a force pump for cleaning drains. (Lower right corner). Place the bottom of the spring, lined with an inner tube, over the mouth of the pipe and pump. —W. T. Markowski.

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# Some Interesting Fountains

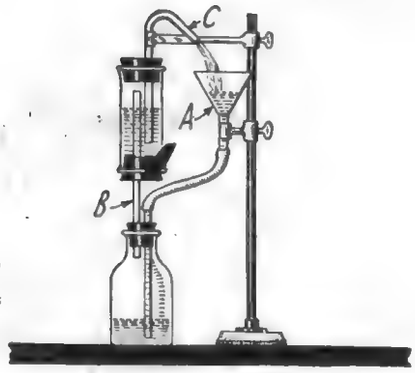


Fig. 1

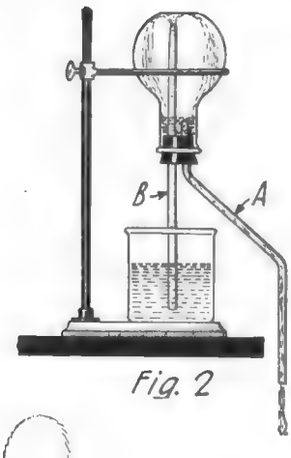


Fig. 2

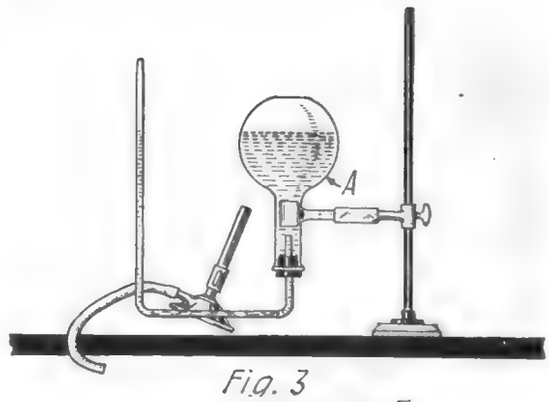


Fig. 3

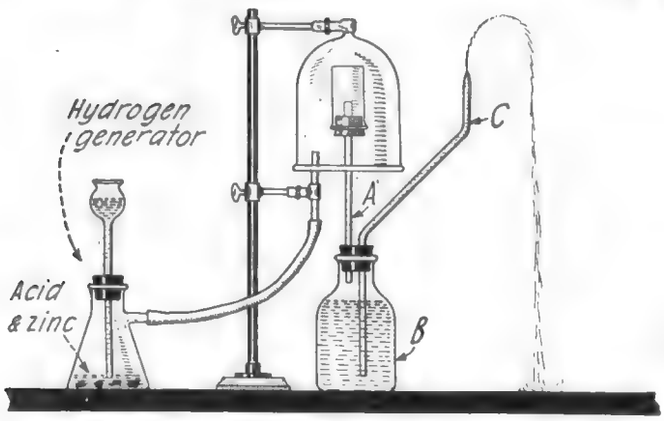


Fig. 4

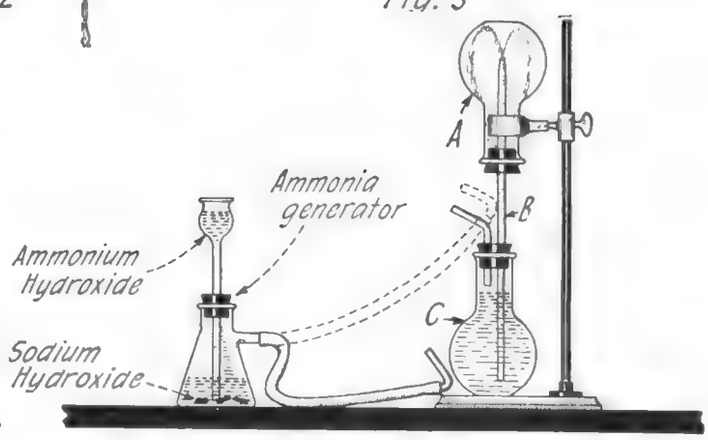


Fig. 5

**Fig. 1.—In this Hero's fountain the column of water in the funnel A and tube compresses air in the bottle. This pressure causes flow through C, back into A. The fountain will operate until water in the upper vessel is exhausted. Fig. 2.—In this siphon fountain the partial vacuum caused in the flask by the water escaping through tube A, causes an inrush through B. Fig. 3.—This illustration shows a steam fountain. Rapidly accumulating steam pressure on the surface of the water in the flask A causes the water to be forcibly ejected from the tube. Fig. 4.—This fountain operates on the varying diffusion rates of gases. Hydrogen introduced into the bell jar diffuses through the walls of the unglazed porcelain cell supported on the tube A much faster than the air in the cell escapes. This causes an internal pressure which causes water to be ejected through C. Fig. 5.—An absorption fountain, started by blowing a little water from C into A, the latter filled with ammonia gas. The water dissolves some of the ammonia, producing a partial vacuum. More water rushes in, and the fountain continues until A is almost filled and the water absorbs all of the ammonia. —Chas. D. Tenney.**

# Home-Made Laboratory Apparatus

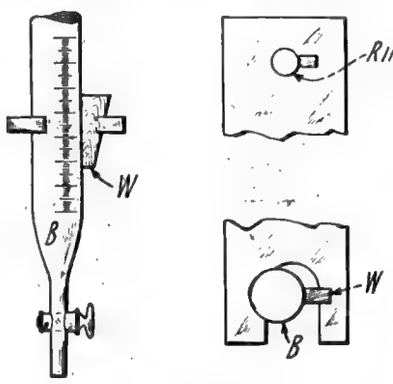


Fig. 1

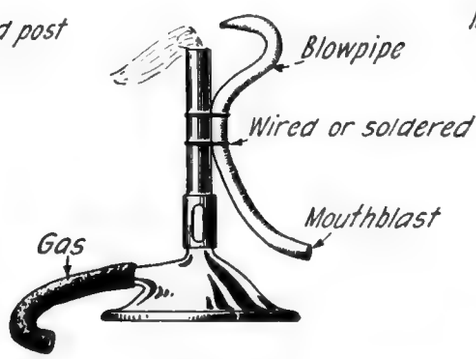


Fig. 2

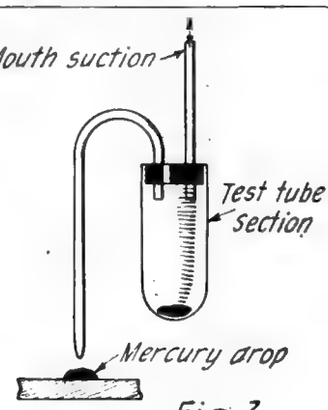


Fig. 3

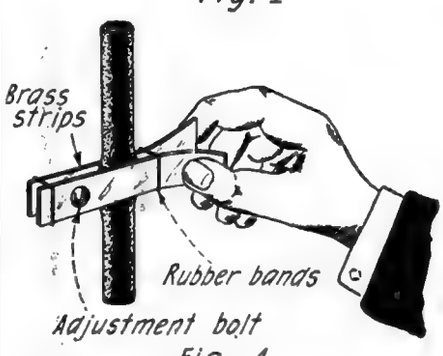


Fig 4

Fig. 1.—This simple burette holder is made of cigar-box wood. It is easily adjusted by means of the wedge and is entirely practical. Fig. 2.—A jeweler's blowpipe soldered or wired to a Bunsen burner as shown makes a useful soldering or blowpiping device that leaves both hands of the operator free. Fig. 3.—This pipette is useful for recovering spilled mercury or handling poisonous liquids. There is no danger of sucking the liquid into the mouth. Fig. 4.—This simple pinchcock is easily made from two strips of brass bent as shown and held together by a bolt. Two rubber bands supply the necessary tension. Fig. 5.—Pocket types of ammeters and voltmeters may be simply and inexpensively converted into desk types with aid of a bit of sheet metal and some cigar-box wood.

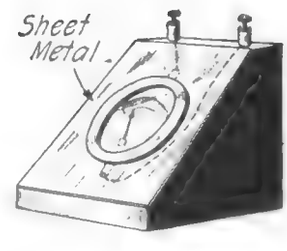


Fig. 5

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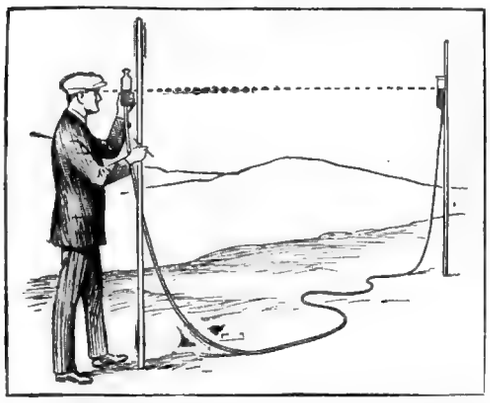
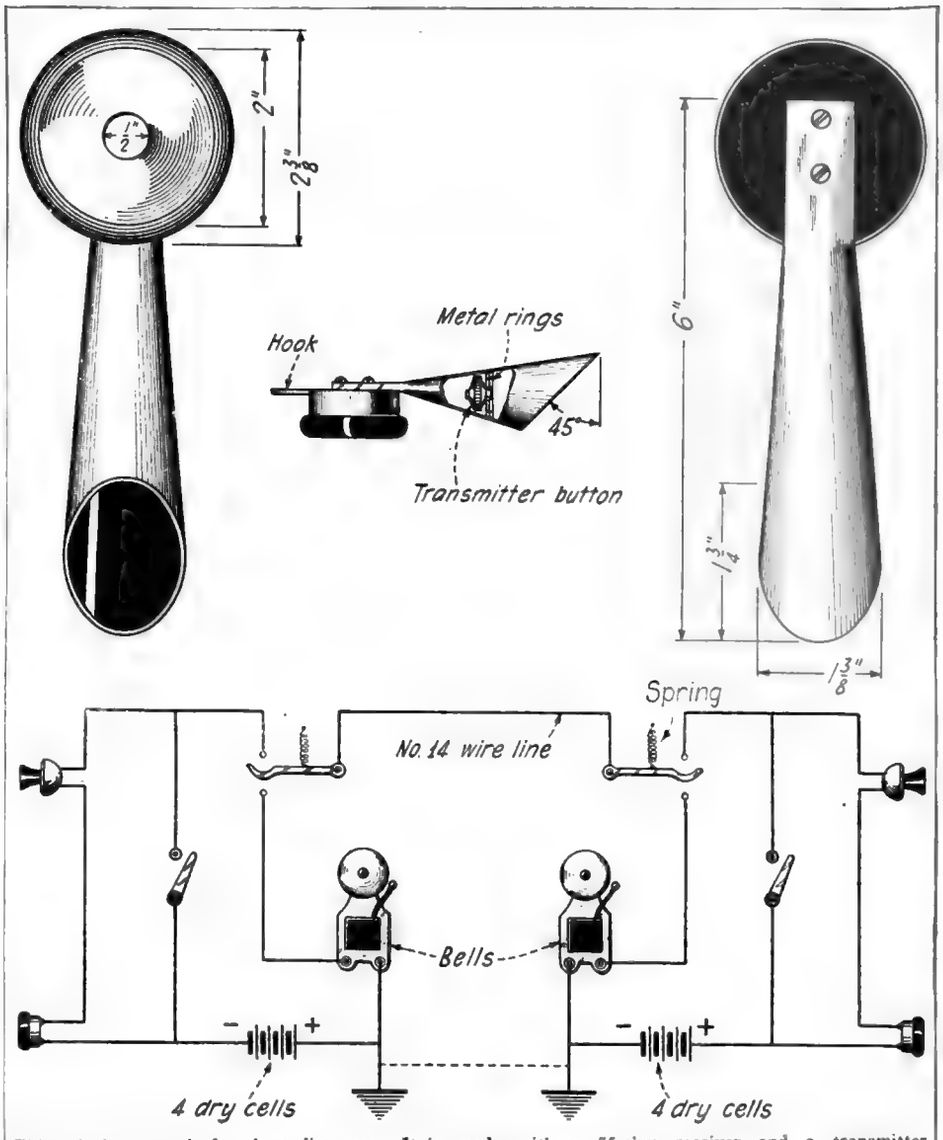
# Cheap Level



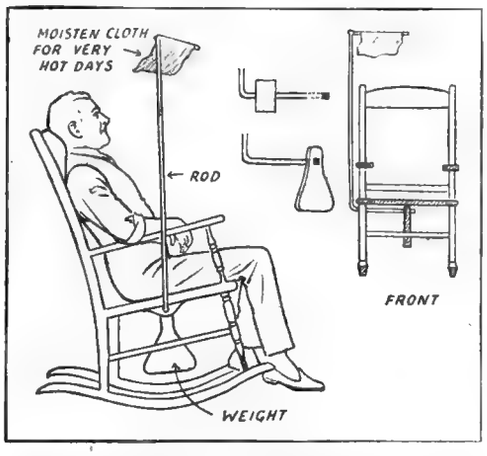
The leveling device shown in the sketch is one devised by Korean contractors. It is constructed of two glass tubes and a length of rubber hose. By mounting one of the tubes on a stick, as shown in the sketch, and raising the other until the water appears in the glass, then sighting over the surface of the water of the second at the column in the first tube a perfect level is produced.—C. A. Sauer.

# Short Line Telephone



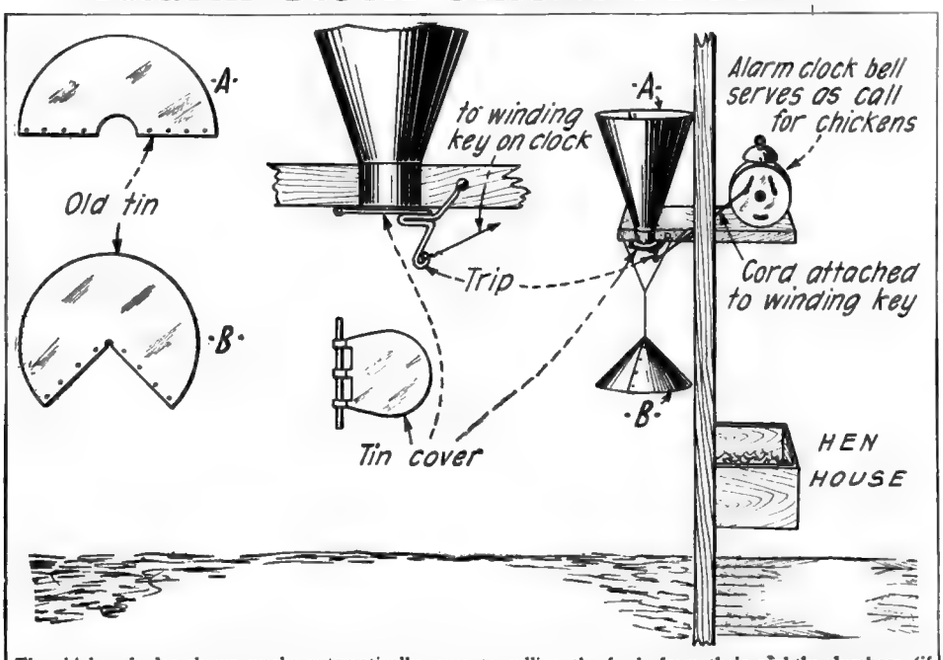

This telephone set is for short distances. It is made with a 75-ohm receiver and a transmitter button. A piece of brass tubing is flattened and bolted to the receiver. The transmitter button is then bolted inside it. The wiring diagram is shown below. The bell, receiver hook and push button are mounted in a box. To operate, take instrument from hook and close push button switch.—T. W. Heine.

# For Hot Days



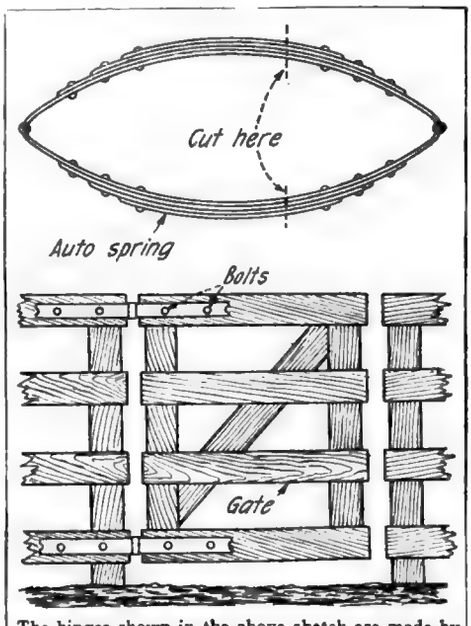

A fan that will operate with the motion of a rocking-chair is shown in the sketch above. Beneath the chair are placed two blocks, bored to be used as bearings for the rod that supports the counterweight. This weight can be of wood. The fan at the top is simply a large cloth slipped over the bent end of the rod.—John F. Pascik.

# Alarm Clock Chicken Feeder




The chicken feeder shown works automatically, even to calling the fowls from their nightly slumbers (if friend rooster hasn't already done it). The funnel under the mouth of the feed magazine spreads the food over the ground so all the fowls may get their share. The trip should work freely and require little power.—Geo. M. Depew, Jr.

# Spring Hinges




The hinges shown in the above sketch are made by drilling holes in leaves of discarded springs after drawing the temper.—G. A. Luers.

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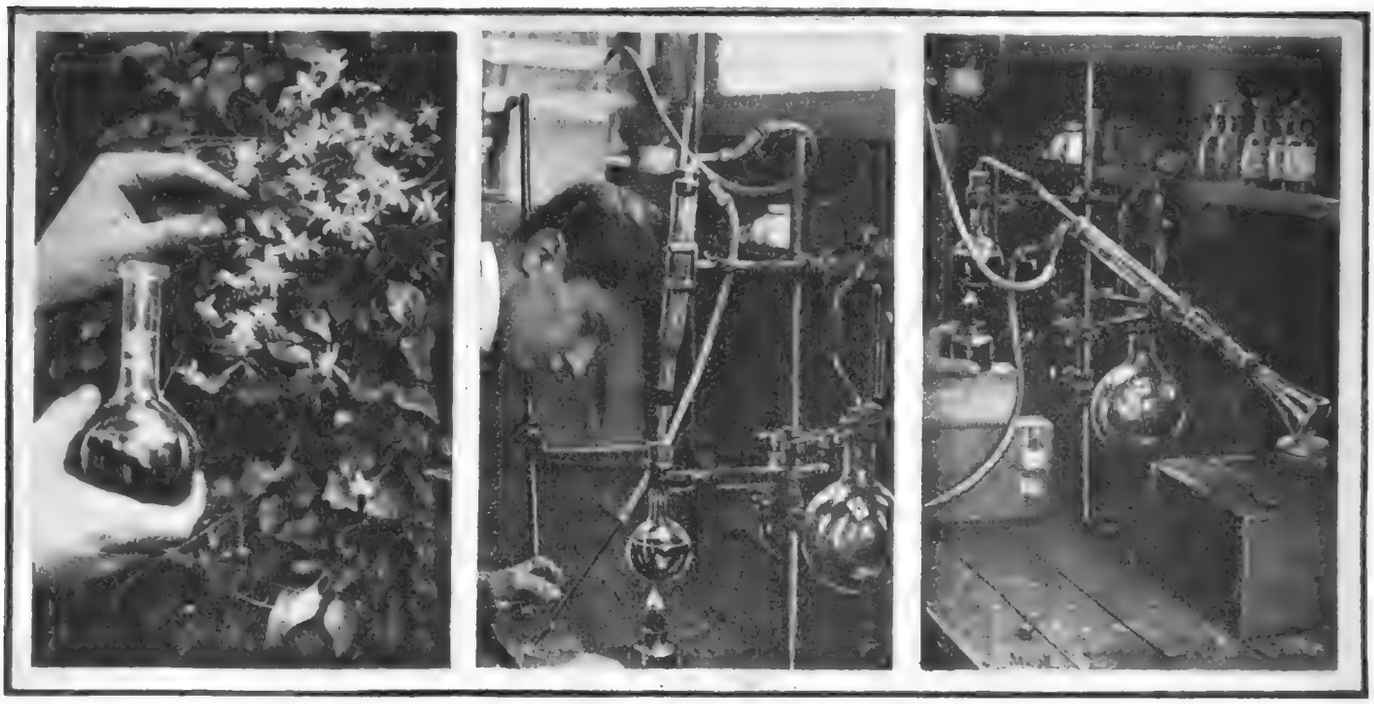
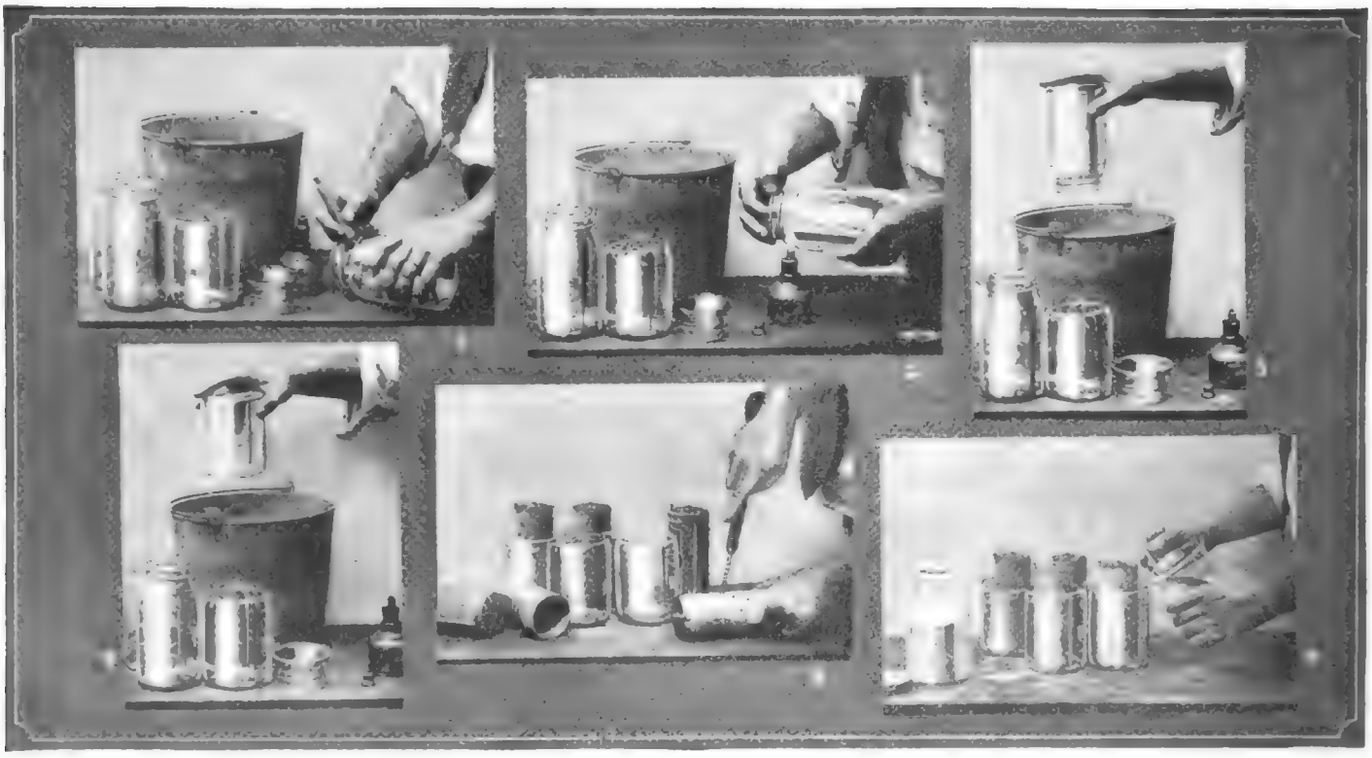
# Perfume Making for Amateurs

**By DR. ERNEST BADE**



The above photos illustrate clearly how any amateur chemist may manufacture his own perfumes. The flowers are gathered early in the morning just after the dew has disappeared. The flower is dropped into a flask and the whole covered with alcohol. The flask is then connected with a condenser, vertically placed, and the mixture is heated slowly for six or seven hours. Then filter the contents of the flask through filter paper. Distill the alcohol from the precipitate and the perfume is left. If it is not strong enough, use more flowers and repeat the process.

# To Restore Dry Batteries



Since the dry battery is simply a modified form of the old Leclanche cell, it may ca[illegible]ought back into service by placing it in a solution of ammo-niun[illegible]-ammoniac. If this chemical is not obtainable, photog-rat[illegible]thiosulphate, may be used, but the results will not be q[illegible]nly necessary to drill (not punch) holes in the sides of [illegible]t in a twenty per cent solution of the salts mentioned [illegible]is trick of bringing them back will be especially use-ful to radio amateurs who operate vacuum tubes with them. The first row of holes in the wall of the cell should be bored half an inch from the bottom, then two other rows are bored at about the same intervals above the first. A row is also bored around the top, above the solution, to allow for the escaping gas. A convenient jar for holding the cells can be made by nick-ing a mason jar below the shoulder with a file or glass cutter, heating the nick and then plunging it in cold water.

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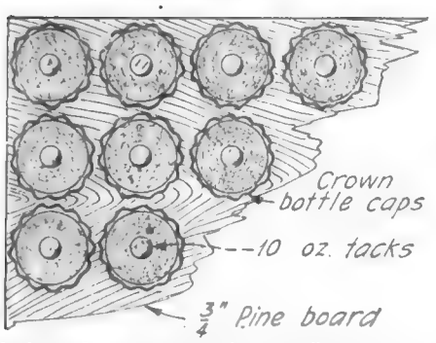
# HOW-TO-MAKE-IT

This department will award the following monthly prizes: First prize, $15.00; second prize, $10.00; third prize, $5.00.
The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of $15.00 is awarded; for the second best idea a $10.00 prize, and for the third best a prize of $5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

## Shoe Scraper

**1st Prize $15.00**




A cheap shoe scraper, much more effective than a fibre or rubber mat, can be made with a few crown bottle caps and 10 oz. tacks as shown in the above illustration. Fasten the base board to the floor. —W. T. Markowski.

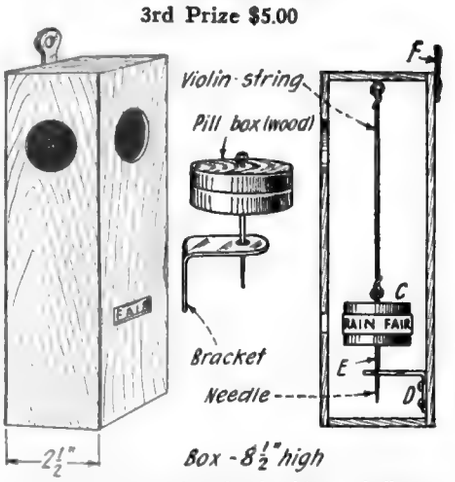
## Scratch-Awl

**2nd Prize $10.00**

In working metals and radio panels a scratch-awl, or stylus, is a necessary part of the workman's equipment. A very handy and serviceable instrument of this type can be made by inserting a phonograph needle in a metal chuck pencil that may be obtained cheaply at any hardware store. —W. H. Holland.

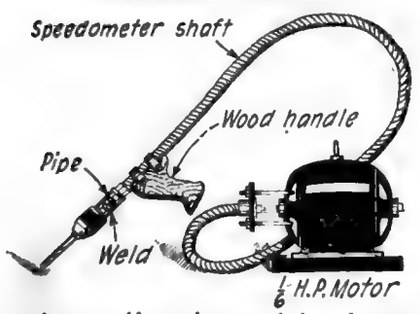
## Barometer

**3rd Prize $5.00**



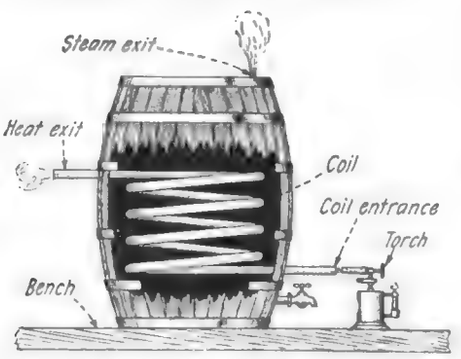

A cat-gut violin string fitted with an indicator as shown makes an excellent barometer. To calibrate it, on a dry day, mark "Fair". Then let a drop of water soak the string and mark "Rain". —Elder Schaffner.

## Snake Drill



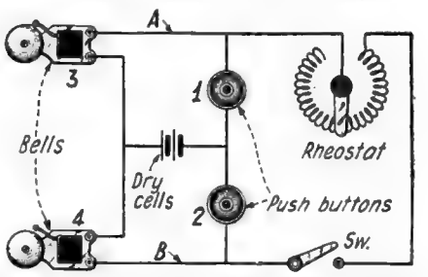

By using an old speedometer shaft and a cast-off drill chuck, a snake drill may be made that will be serviceable in inaccessible places. The motor shaft is slotted to take the speedometer shaft and the chuck is welded to the other end. The pipe just behind the chuck takes up the thrust. —Harold Jackson.

## Blow Torch Boiler



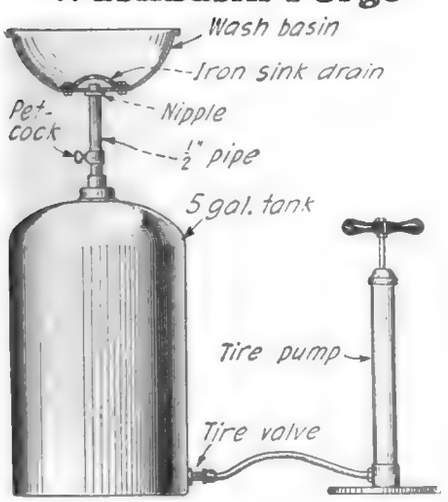

A length of one and one-half inch pipe coiled and inserted in a barrel as shown makes a fifty gallon boiler. If a three-inch nipple about six inches long is fitted over the end of the coil taking the blow torch so that the head of the torch may be inserted into it, better results may be gained. A cock is fitted to the bottom of the barrel for drawing off the water.—L. M. Jordan.

## Door Bell Circuit



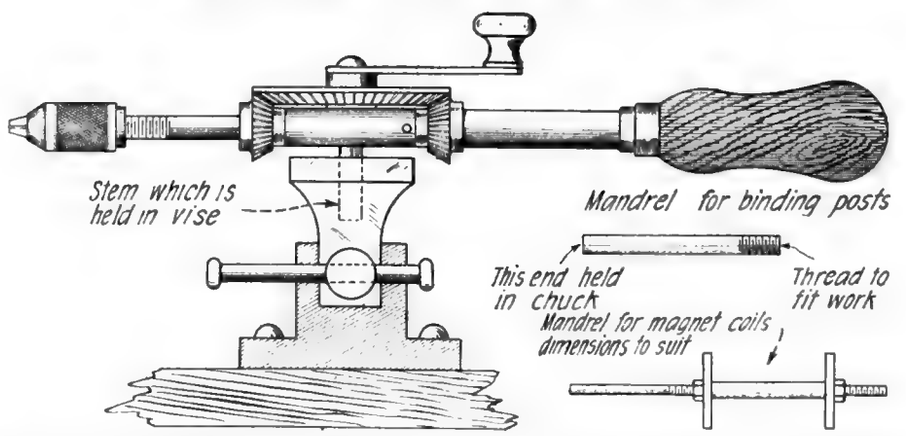

In the double door bell circuit shown both bells may be rung with either button. The resistance inserted in one of the circuits gives each of the bells a different tone. The switch separates circuits. —S. S. Peszel.

## Washbasin Forge




By drilling a hole through the bottom of a discarded wash-basin and covering it with a sink drain and inserting the air lead, a very handy small forge can be constructed. The petcock regulates the flow of air from the tank.—John F. Pascik.

## Small Lathe from Breast Drill


Stem which is held in vise
Mandrel for binding posts
This end held in chuck
Thread to fit work
Mandrel for magnet coils dimensions to suit

If the small handle, opposite the large gear wheel on a breast drill, is removed and the stem is supported in a vise, a small lathe is the result. A motor may be attached to the large gear for running it. This lathe will find many uses in winding coils, dressing round work and polishing. In winding coils with its aid, a mandrel, such as the one shown should be constructed. In polishing or finishing binding posts, another is used. A couple of pieces of copper facing the [illegible] save the drill spindle.

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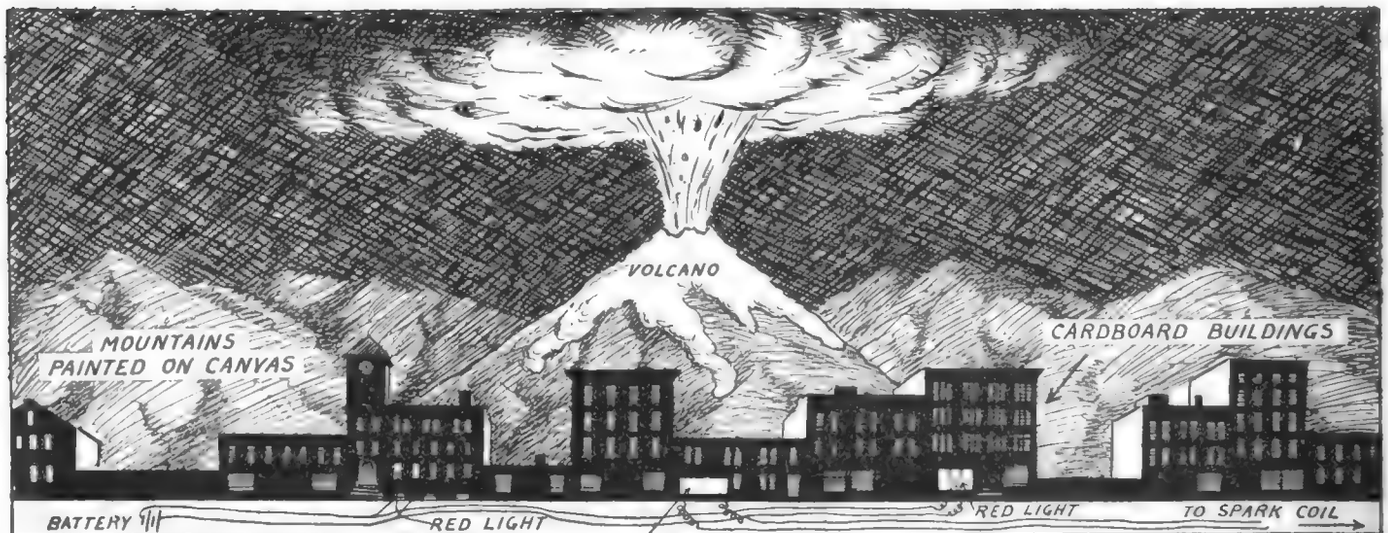
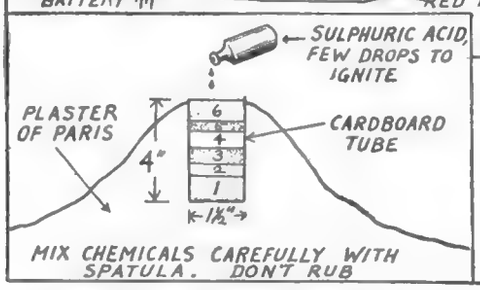
# WRINKLES
## RECIPES & FORMULAS

# Miniature Volcano Eruption Scene

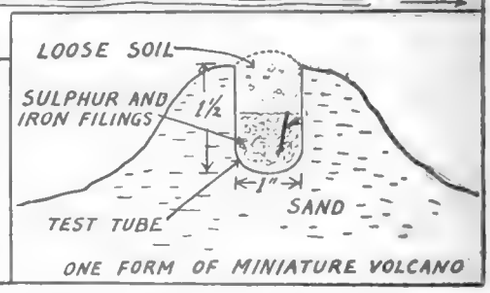
THIS MONTH'S $5.00 PRIZE TO ORHAN R. COBLENTZ.




PAN OF POWDER—SAME AS #2 ELECTRICALLY IGNITED IN TABLE

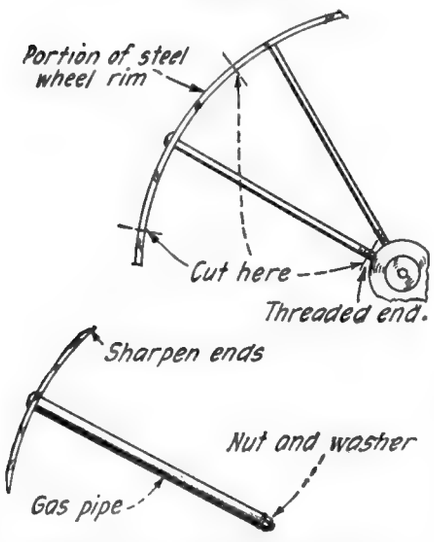
Parts by Weight: No. 1—Sulphur 2, Charcoal ½, Magnesium (powder) 1, Iron (filings) 1, Sugar ½, Potassium Chlorate 2. No. 2—Sulphur 2, Charcoal 1, Potassium Nitrate 2, Strontium Nitrate 3. No. 3—Sulphur 2, Charcoal 1, Potassium Nitrate 2, Barium Nitrate 3. No. 4—Sulphur 1, Potassium Nitrate 2, Charcoal 1½. No. 5—Sugar 1, Iodine ½, Sodium Nitrate ¼. No. 6—Sugar 2, Potassium Chlorate 2½.




A miniature volcanic eruption that will produce all the details and thrills of the real explosion can easily be made with the help of a few chemicals. First construct the stage setting as shown in the top sketch. The houses are of painted cardboard. They are set in front of a background painted on canvas. Lights are placed inside the houses as shown. The volcanic mountain is made of plaster of Paris into which the cardboard tube, shown in the drawing at the extreme left, is placed. The chemicals listed above are placed in the tube as follows: One inch of number one, one-half inch of number two, three-quarters of an inch of number three, three-quarters of an inch of number four, one-fourth of an inch of number five, and lastly three-quarters of an inch of number six. To set off pour 5 c.c. sulphuric acid (C.P.) on the top, keep the face at a distance. The scene will be realistic, according to its originator. —Orhan R. Coblentz.

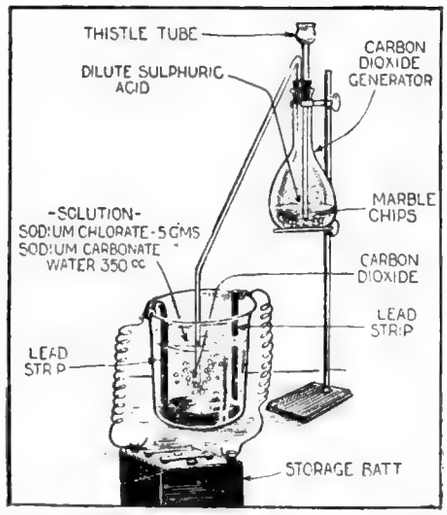
Another volcano, more easily constructed is shown in the right hand sketch. The mound is filled with a mixture of iron fillings, dampened, and flowers of sulphur. It explodes automatically. —A. D. Turnbull.

## Adz from Wagon Wheel



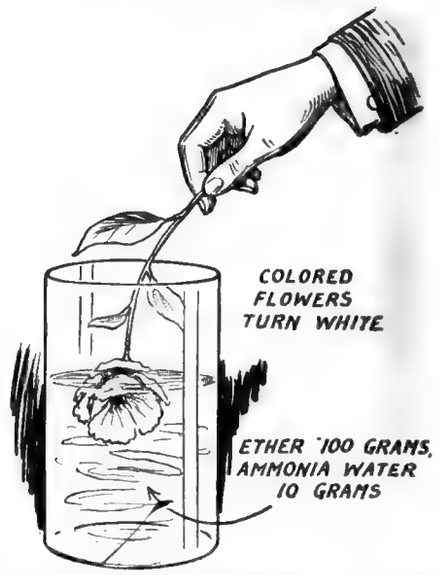

By cutting the rim of an iron wagon wheel twelve inches from the spoke and then st[r]ing and sharpening it, a good adz can be ted. One end of the spoke is threaded of gas pipe is fitted over the spoke an[d] with a nut. —Dale R

## Lead Carbonate Reduction




The electrolysis in the experiment above allows [d]irect reduction of lead carbonate, from which [p]aint is made. For best results the solu[t]electrolysis, should be made of 15 grams [u]m Chlorate and 5 grams of Sodium Car[a]nd 350 cc. of water. It should be stirred [h]e experiment is in progress.
—Orhan R. Coblentz.

## Bleaching Flowers by Dipping




By dipping any colored flower into a solution of 100 grams of ether to which 10 grams of ammonia water has been added the flower will slowly bleach. —Elmer Garbella.

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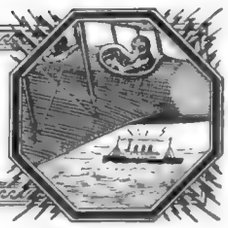
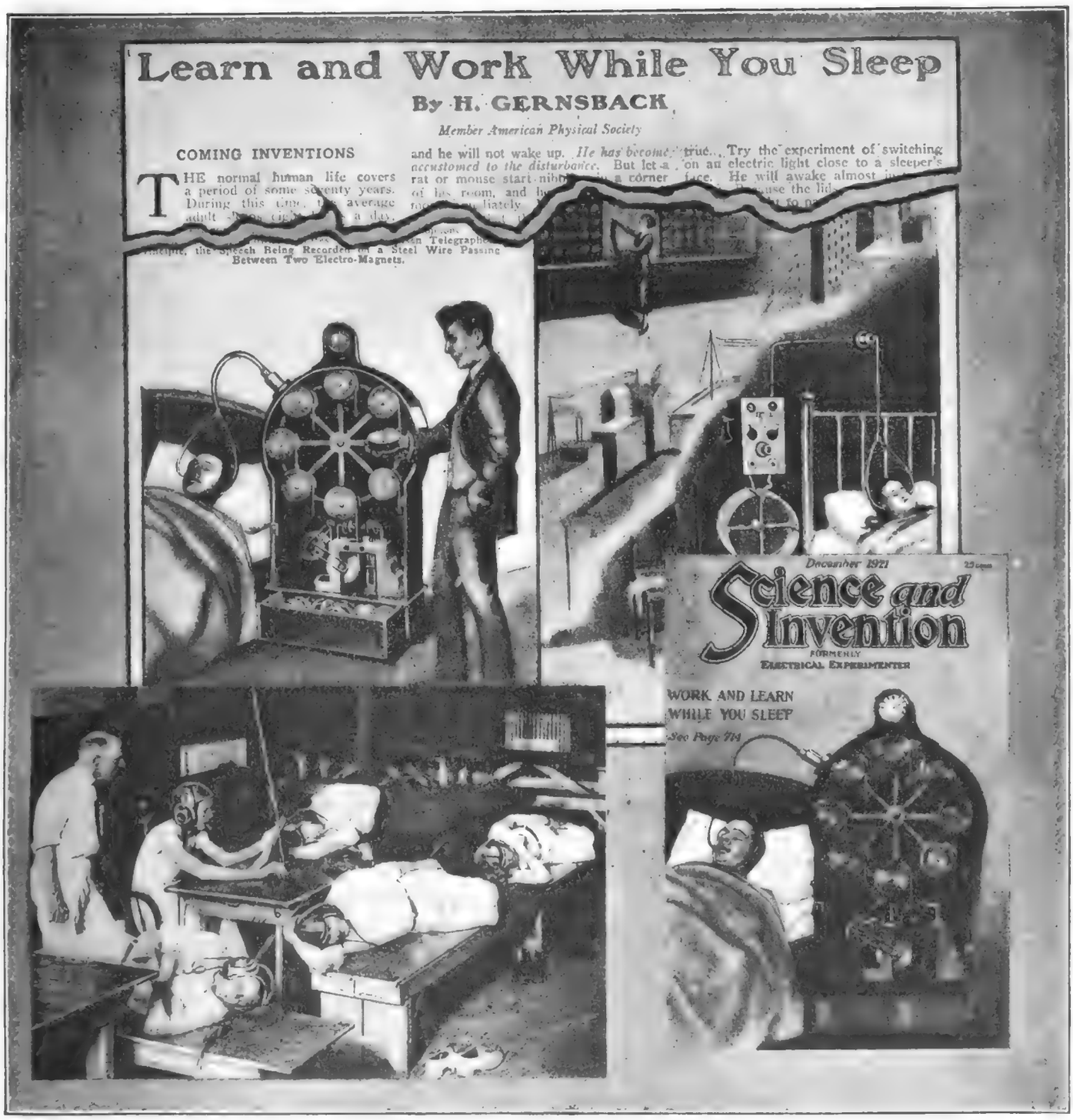
# RADIO



# Students Learn Code While Asleep

**By S. R. WINTERS**




**Another prophecy comes true! In the December, 1921 issue of SCIENCE AND INVENTION, there appeared an article by the editor stating that, due to the fact that the sub-conscious mind never sleeps, it would soon be possible to use the sleeping hours for study. Today that prophecy is a fact. At the bottom of the above cut is shown the interior of the Naval Radio Training School for airplane pilots at Pensacola, Florida, where students receive code practice while asleep. Twelve students who had difficulty in mastering the code in the regular way began practice in this way and in two days showed improvement. If there was a change in speed or mistakes in sending they tossed about in their sleep. If an SOS distress signal is sent they immediately awake. They learned through this method w[illegible] others failed. The device was put into practice by Chief Radio M[illegible]**

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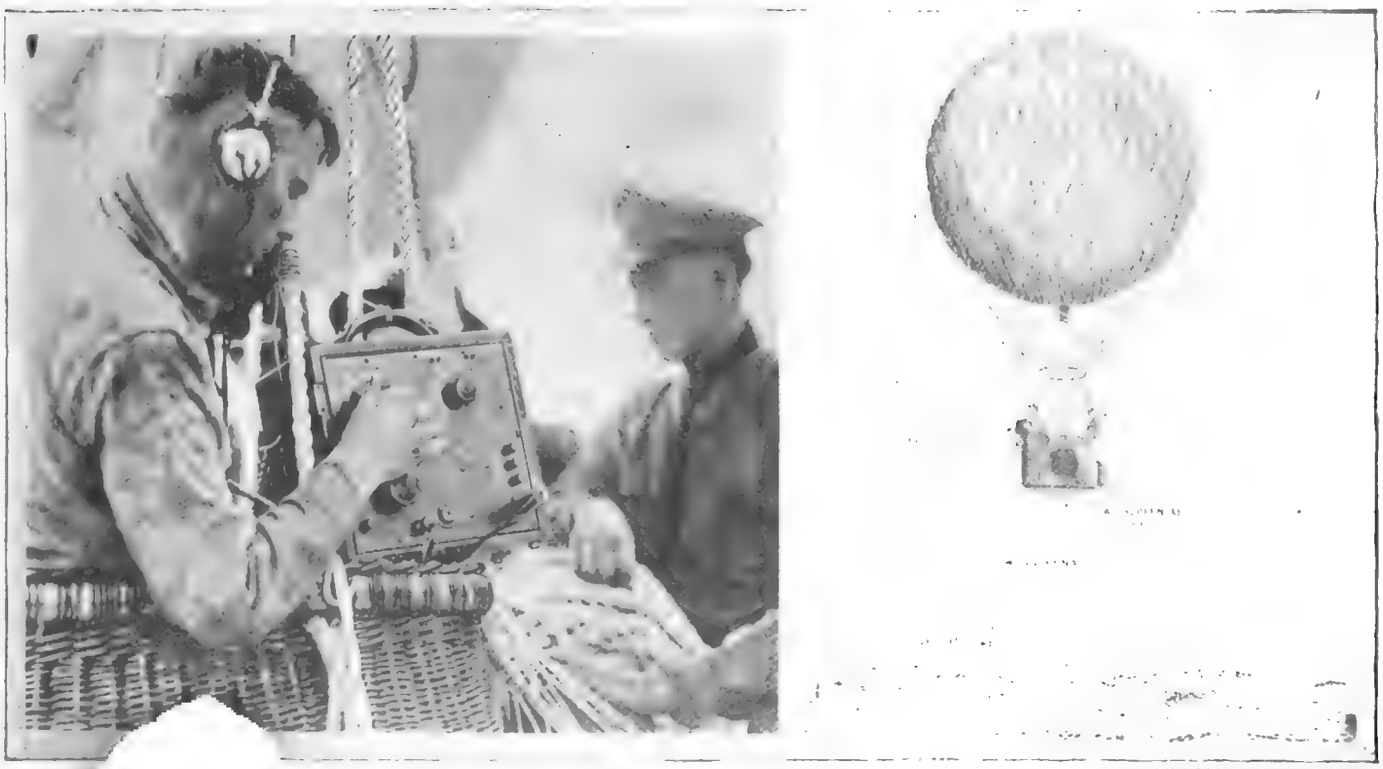
# Radio and Loud Speaker in Boys' Camp

Scenes at Boy Scout Camp "Glen Gray," Oakland, N. J., where a receiving set and loud speaker are installed. Above is shown Director F. F. Gray reading to the Scouts, for literature is not neglected in their curriculum.

Reveille at camp is shown in the center picture. Note microphone on the table. Above "Dave the cook" turns from artichokes to art and regales the camp with jazz. Center below shows installation of horns for the addresser.

# Radio in the Open Balloon Race



Official Photo, Army Air Service

'To while
apolis
a coun
nours of the open balloon race, held at Indian-
ny teams swung out an antenna and installed
d so listened to the broadcast programs. The
radio set also enabled the team shown to take the race since they were kept advised of weather conditions and the locality and distance of their opponents at all times during the race. —Capt. Frank Lemrah, A. S. R.

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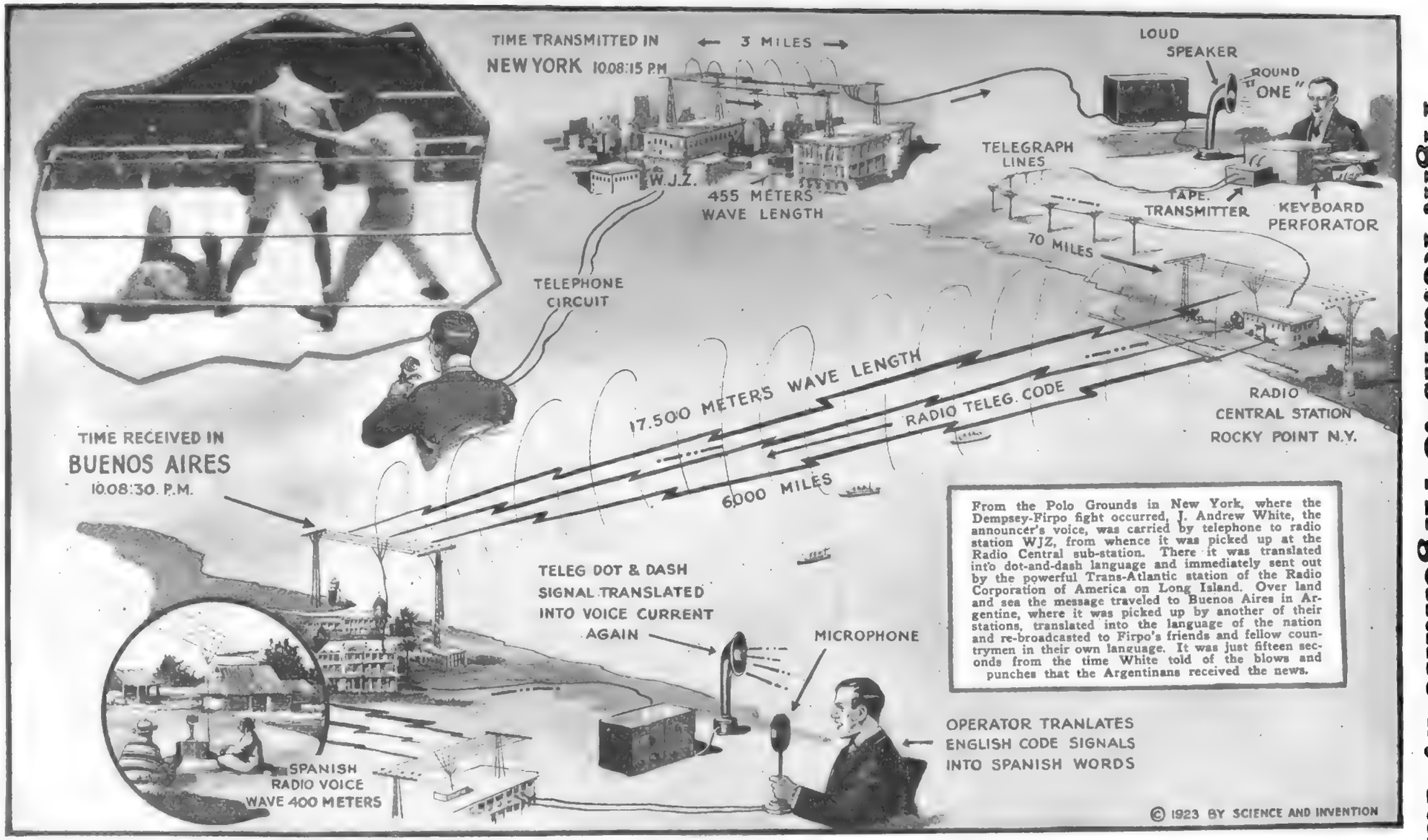
# Fight Returns to Argentine by Radio




From the Polo Grounds in New York, where the Dempsey-Firpo fight occurred, J. Andrew White, the announcer's voice, was carried by telephone to radio station WJZ, from whence it was picked up at the Radio Central sub-station. There it was translated into dot-and-dash language and immediately sent out by the powerful Trans-Atlantic station of the Radio Corporation of America on Long Island. Over land and sea the message traveled to Buenos Aires in Argentine, where it was picked up by another of their stations, translated into the language of the nation and re-broadcasted to Firpo's friends and fellow countrymen in their own language. It was just fifteen seconds from the time White told of the blows and punches that the Argentinans received the news.

**By H. WINFIELD SECOR, E. E.**

THE 85,000 spectators at the ringside who saw Dempsey knock Firpo to the canvas for ten counts, constituted only infinitesimal part of the audience that yed one of the liveliest clashes in ring ory. Six thousand miles from the ringe some of the most eager fight fans lised tensely to a blow by blow description the fistic engagement. This invisible audience was Firpo's own. They listened over their receiving sets through the intermediary of the most powerful radio station in the world, Radio Central, located at Rocky Point, Long Island.

The manner in which the transmission was carried out is represented schematically in the drawing.

During the period of the bout Radio Central's signals were picked up by the high power receiving station at Buenos Aires. Thus, 6,000 miles away, through Monte Grande, over great expanses of water and long stretches of land the progress of the big bout, described by J. Andrew White, journeyed to the native land of Firpo.

The range of Radio Central is sufficient to carry the news of the battle at New York not only to radio fans in the Argentine, but to Chile, Paraguay and Uraguay.

From the moment the referee reached his tenth count while Firpo lay upon the canvas after a blow delivered by his opponent, *only 15 seconds* were consumed in transferring the news from New York City to the countries in South America.



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# Radio--All Over the Place

Romany doesn't depend upon a scratchy old fiddle in the back of the caravan for the evening's entertainment any more. These Gypsies camped recently in New Jersey and threw up an antenna almost before they fed the horses. They ate their supper by campfire and the music of WOR and WMAB.

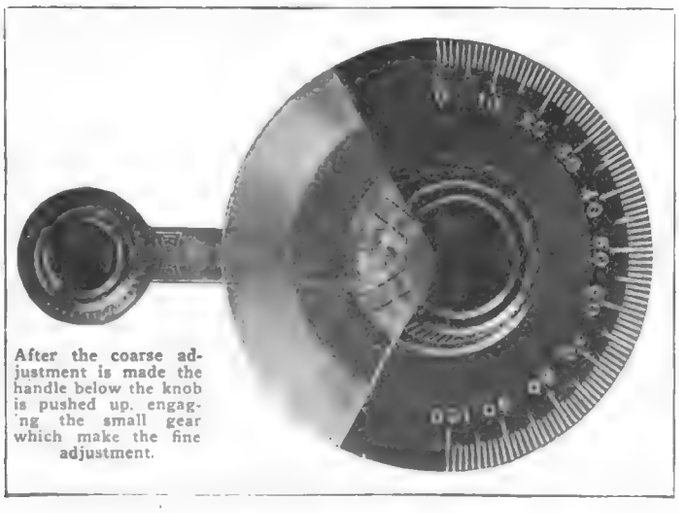
© by Western Electric Co.

Even the farm lightens the boredom of hay making with a couple of grand opera aerias. Note the fair driver on this Vermont farm enjoying selections from Pagliacci while she collects Dobbin's winter food.

"Ritzy" doesn't know quite what it is all about but he figures that if his owner, the enthusiast who spends his salary on tubes and "B" batteries, stays away long enough he will find out. In the photo to the left he is just giving the loud speaker the final O. K. before starting an investigation of the variables and honeycomb coils.

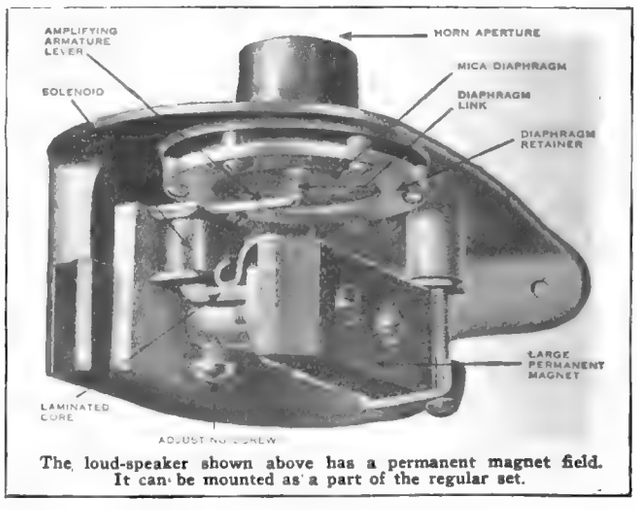
An English firm doing a large retail radio business decided that the overhead of delivering "B" batteries and 10 feet of bus-bar wire could be lowered by having the office sign painter do his stuff on the side of the delivery cart. The antenna is by the office boy; the variable knobs by the carpenter.

## Condenser Vernier



After the coarse adjustment is made the handle below the knob is pushed up, engaging the small gear which make the fine adjustment.

## New Loud-Speaker




The loud-speaker shown above has a permanent magnet field. It can be mounted as a part of the regular set.

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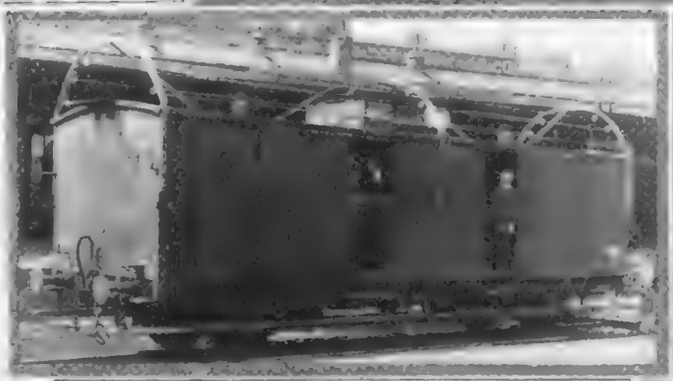
# Radiophone on French Trains

**By A. N. MIRZAOFF**

Above is shown one of the "fixed" radiophone receiving and transmitting stations installed by the French State Railways with which they have been making extensive tests. The "fixed" stations, installed in cars, are set on sidings and used to communicate with the "moving" sets aboard trains. The "fixed" stations are moved from point to point as the experiments require.

At the right is seen the exterior of the car housing the "fixed" station and the method of installing the antenna upon the adjacent telegraph poles, on a cross-arm.

Here are shown engineers representing the Compagnie Telegraphique making experiments at the "fixed" station shown in the photo at the top of the page. Power for operating the transmitting set was obtained from a small motor-generator working on a storage battery. A number of different circuits were used and the results obtained with each were carefully tabulated.



The method used for supporting the antenna for the stations attached to moving trains is shown in the photo above. The stretcher across the top of the car is of metal and is insulated from the body of the car. The lead-in is taken from the end of the car where the instruments are installed.

A "close-up" of the movable station's apparatus is shown in the photo to the left. The receiving instruments may be seen to the extreme left. Practically only standard equipment was used in the tests.

To the right is shown one of the engineers making tests from one of the movable stations while the train to which it was attached was running from Paris to Lyons. Communication was maintained practically all through the journey between the cities.

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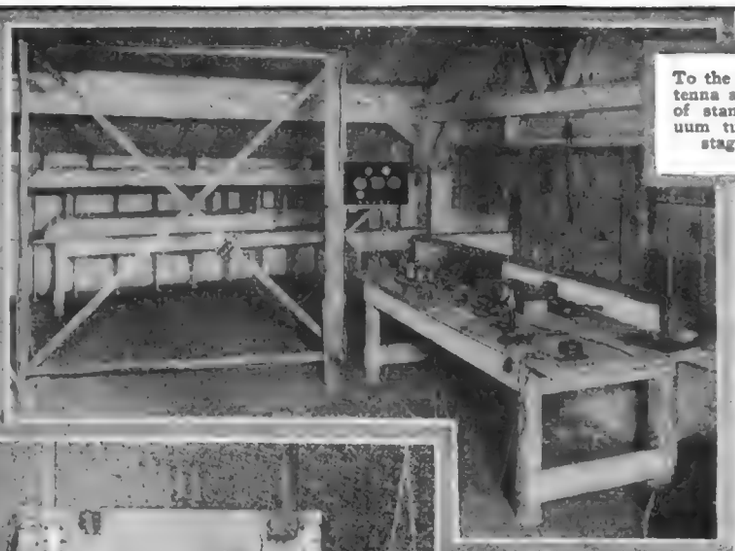
# Broadcast Relay on 100 Meters

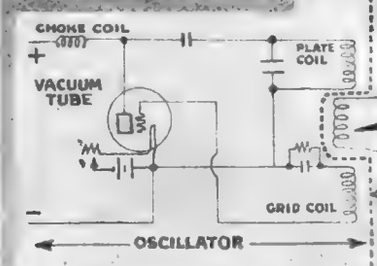
**By HOWARD ALLEN DUNCAN**

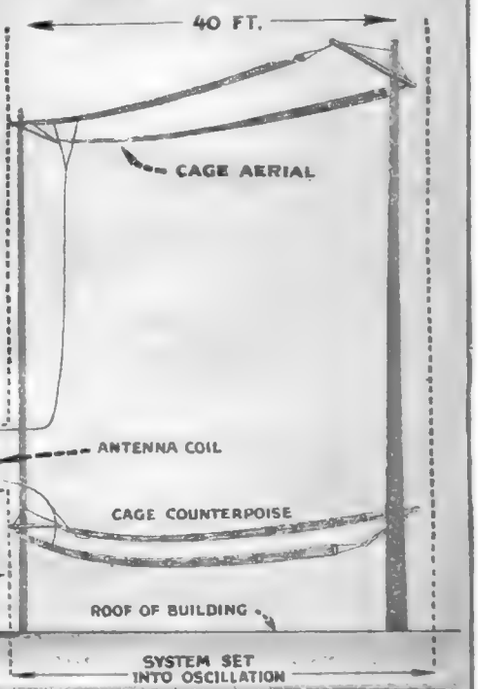
©1923 BY SCIENCE AND INVENTION



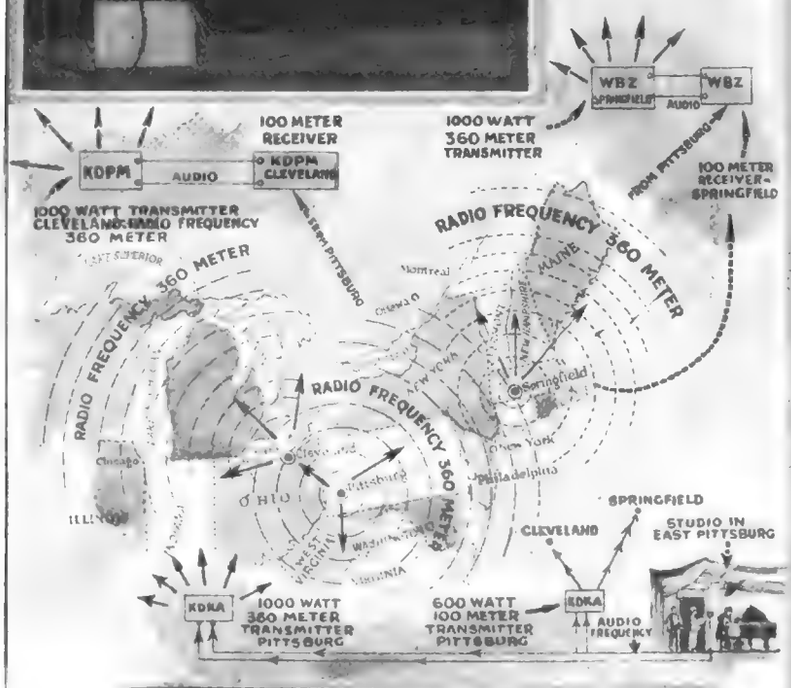
To the left is shown loop antenna and receiver consisting of standard one-circuit vacuum tube detector and two stages of amplification.

At the left is shown the 250-watt transmission set — directly connected to the receiver — which sends out the 100 meter broadcast at KDPM, Cleveland, relayed from East Pittsburgh, which originates the program.




Above diagram shows the aerial arrangement used to relay the 100 meter waves. The counterpoise keeps the tuning sharp. The sketch also shows the wiring diagram for the transmitter, which uses one oscillating and one modulating tube. This system is used at all sub-stations.



how broadcast on 360 and 100 meters simultaneously at KDKA ip and relayed at Cleveland (KDPM) and Springfield (WBZ). right is seen the counterpoise and antenna on KDKA.

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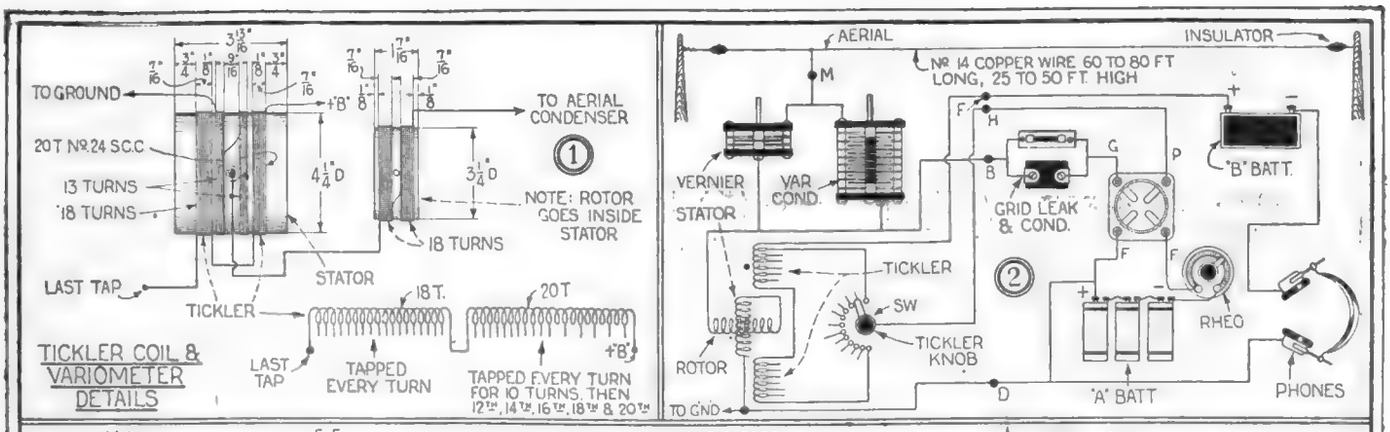
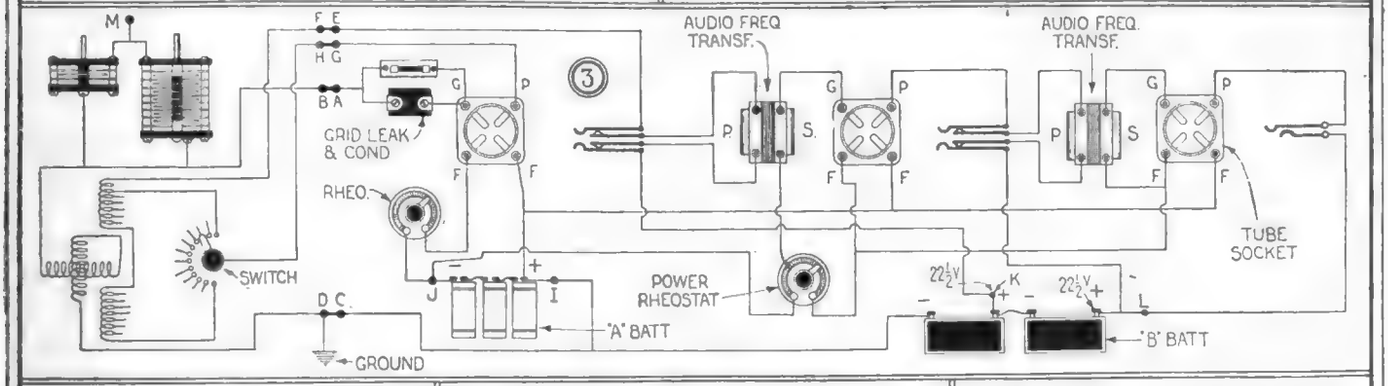
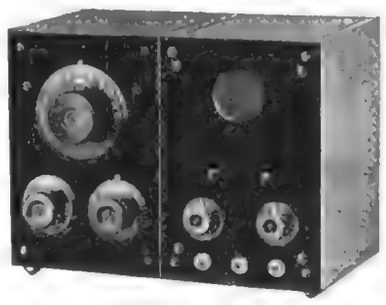
# Good Single Circuit Receiver

**By H. ALLEN DUNCAN**



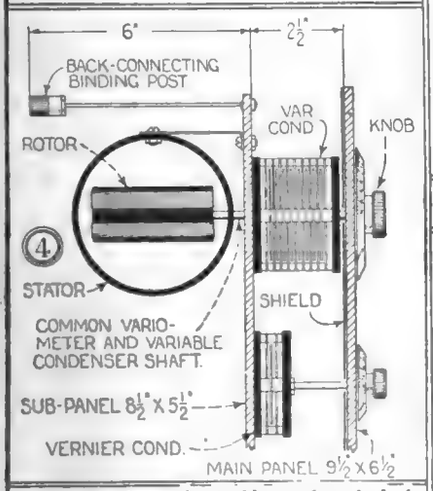




This standard receiver, wiring diagram of which is shown above, has the advantage of a fairly wide range of wave-lengths and simplicity of control. In Fig. 1 is shown the details of the tickler and variometer. Fig. 2 gives the wiring of the set used as a regenerative receiver. Fig. 3 shows the hook-up of the complete apparatus using audio amplification.

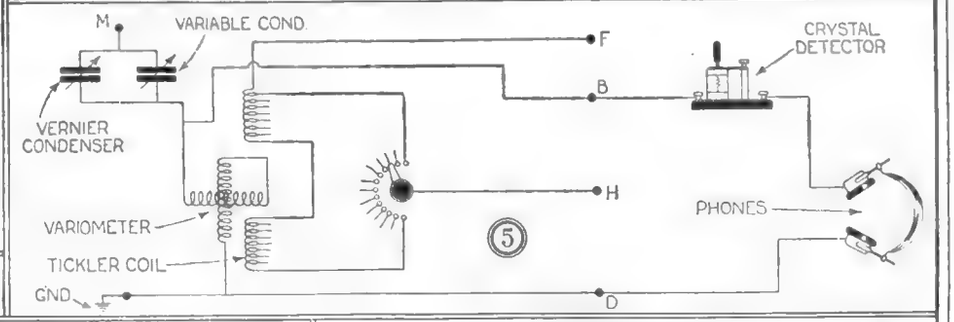


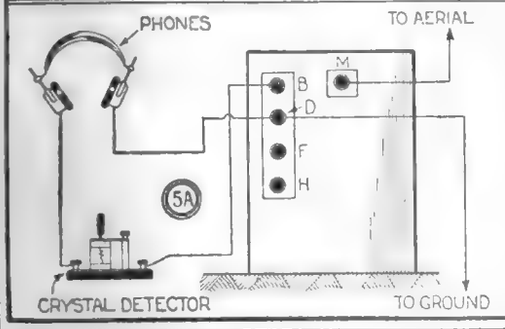
Above is shown the exterior of the set. The cabinets contain the tuner, detector and amplifiers.

Below is shown one of the many hook-ups obtainable with the outfit. By building the tuner and the detector-amplifier units in separate cases and making them independent of each other, the set lends itself easily to experimental uses. By mounting the variable condenser and the variometer on the same shaft the tuning control is vested in one knob. Behind the main panel at the front of the set is mounted a second smaller panel which is used to support the condenser, vernier condenser and the variometer as well as the taps for the tickler. Connections between the two units are made by binding posts at the rear of the cabinets. The tuner will cover waves from 170 meters to 800 meters. With a loading coil which may be installed without disturbing the wiring of the remainder of the set, 2,800 meters can be tuned in. Jacks for detector, one and two steps of amplification are furnished.

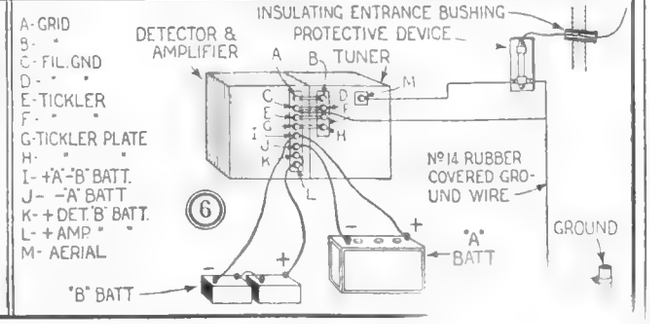



Above is shown the double panel method of mounting. All binding posts are mounted on the rear of the cabinet.




At left is shown connections for using the tuner unit in connection with a crystal detector. At right is shown complete hook-up when both units are used. Aerial for this set should be between sixty and eighty-five feet in length for reception of broadcast waves. For best results, it should be placed as high as possible and away from all surrounding objects.

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# Cockaday Four-Circuit Tuner

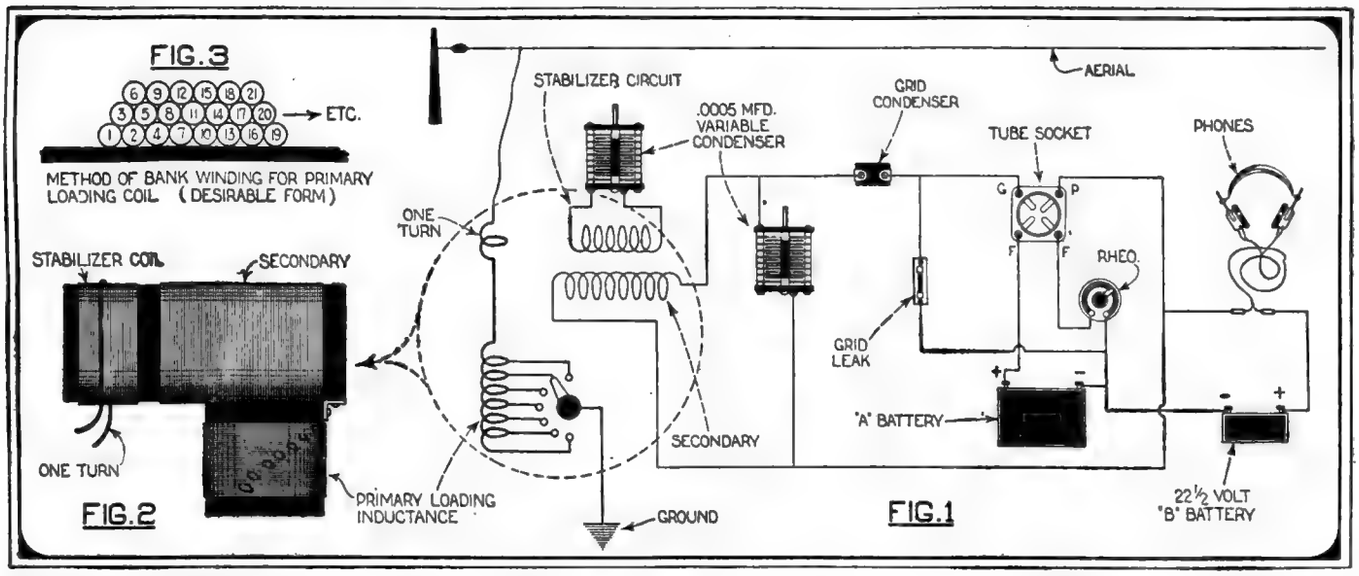



Fig. 1; Circuit of the Very Selective Cockaday Four-Circuit Tuner. Fig. 2; Position of the Coils, All Wound on 3½ Inch Tubes. The Stabilizer Coil Consists of 35 Turns of No. 18 S. C. C. Wire, the Secondary 65 Turns of the Same Size and the Primary 43 Turns, Bank Wound. (Fig. 3) Tapped at the First, Fourth, Eighth, Fourteenth, Twenty-Second, Thirty-Sixth and Last Turns. The One Turn is of Square Bus Bar Wire. —By Leroy Western.

# A 50 Cent Loud Speaker

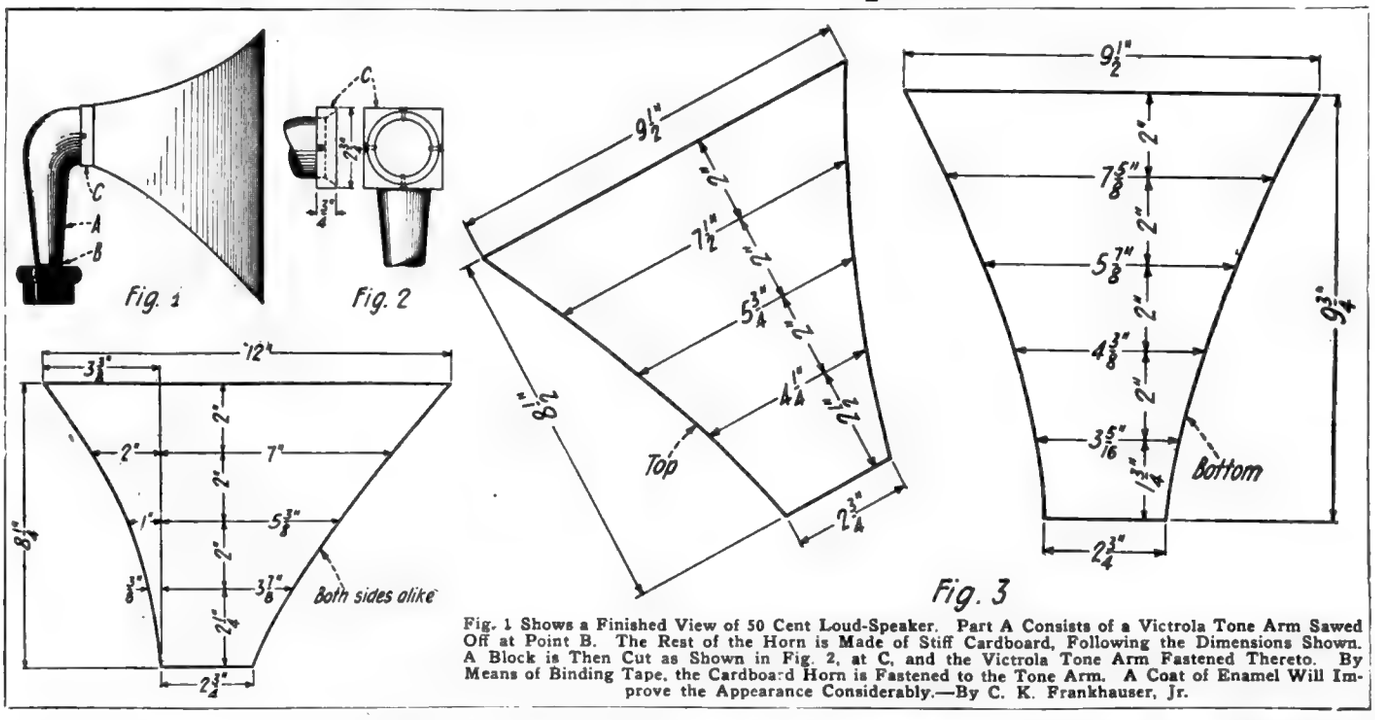
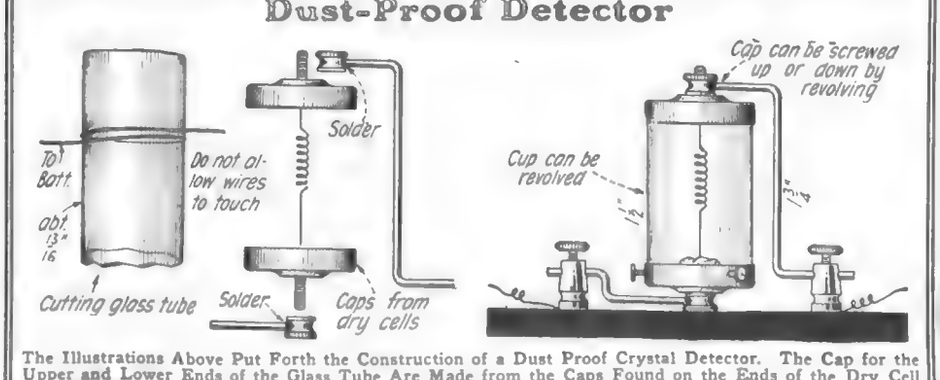



Fig. 1 Shows a Finished View of 50 Cent Loud-Speaker. Part A Consists of a Victrola Tone Arm Sawed Off at Point B. The Rest of the Horn is Made of Stiff Cardboard, Following the Dimensions Shown. A Block is Then Cut as Shown in Fig. 2, at C, and the Victrola Tone Arm Fastened Thereto. By Means of Binding Tape, the Cardboard Horn is Fastened to the Tone Arm. A Coat of Enamel Will Improve the Appearance Considerably.—By C. K. Frankhauser, Jr.

## Dust-Proof Detector




The Illustrations Above Put Forth the Construction of a Dust Proof Crystal Detector. The Cap for the Upper and Lower Ends of the Glass Tube Are Made from the Caps Found on the Ends of the Dry Cell Carbons. The Glass Tubing May Be Cut to the Size Desired by Electricity as Described in the Oracle Department in the October, 1922 Issue. This Method is Illustrated at the Extreme Left.—By S. Kruythoff.

## Lightning Gap

Lightning Protector Formed by a Spark Plug Screwed Into a Grounded Iron Pipe. Separate Points by Thickness of This Page.

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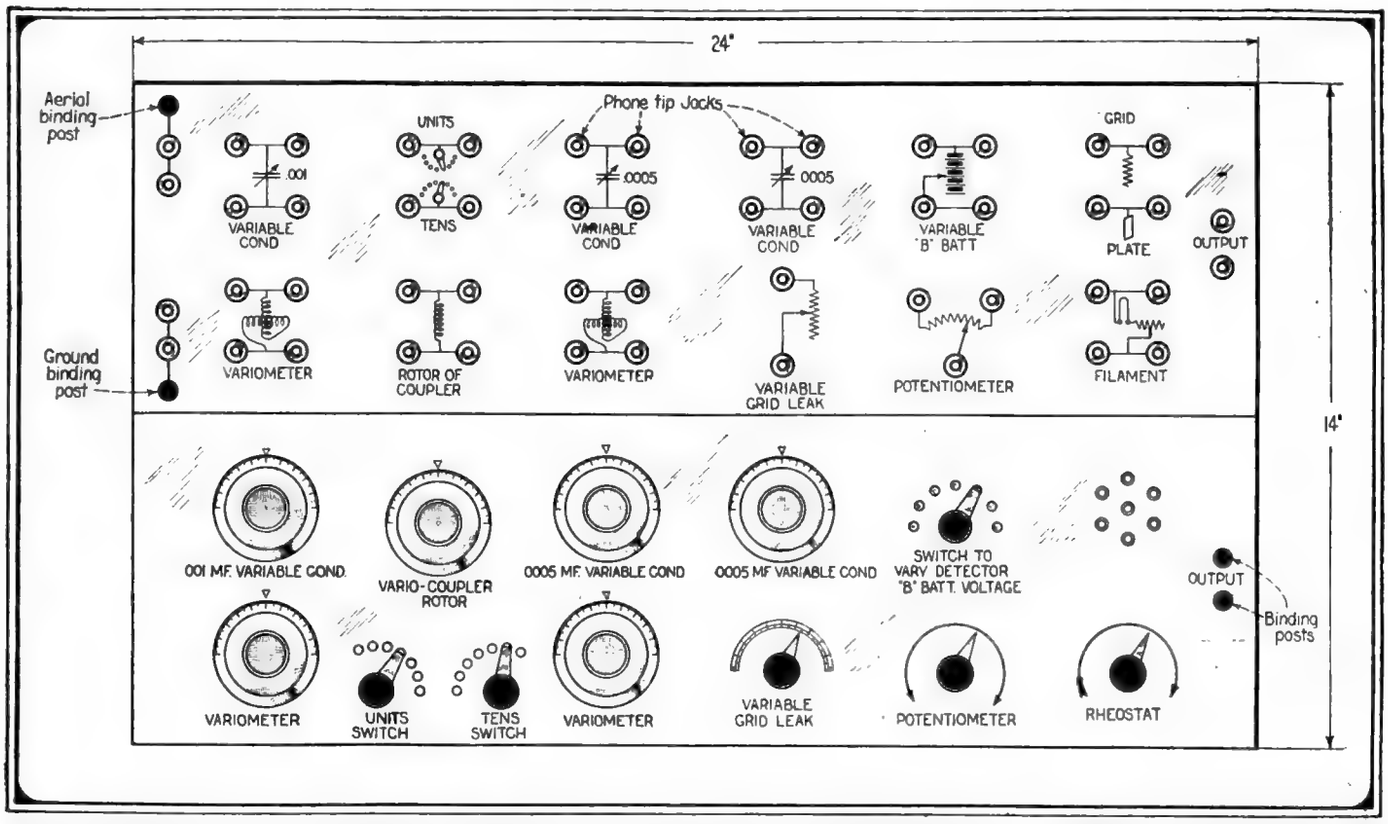
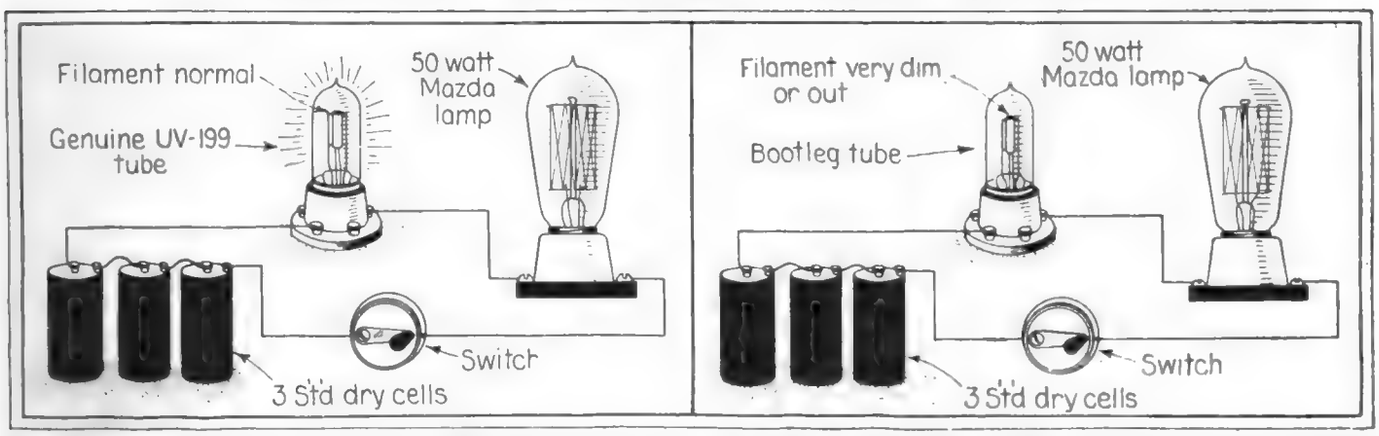
# An Experimental Circuit Panel

**By R. D. B. WASHBURNE**




By using a panel twice as wide as the ordinary radio receiving set panel and placing a number of phone tip jacks on the upper half, as illustrated above, practically any known circuit may be tried out. The jacks are connected to the instruments as illustrated and connections between them are made by means of flexible wires on the ends of which are phone cord tips. Many other variations of this principle will suggest themselves to the constructor.

# Handy "Bootleg" Tube Sleuth




The difference between a bootleg tube and a standard U.V.-199, may be readily ascertained by means of the connections shown above. If the tube is genuine, the filament will light to a normal brilliancy, while if it is of the bootleg type, which draws a greater amount of current, the filament will not light to normal. This is because the 50-watt Mazda lamp does not allow sufficient current to pass to light the bootleg filament.


## THE GREAT RADIO AMATEUR NUMBER!

DO NOT FAIL to read the November issue of RADIO NEWS, which is the biggest "Amateur" number ever put out by any radio magazine since the beginning of the art. It contains articles by some of the foremost amateurs in the country.

### THE AUTOPLEX CIRCUIT

The latest thing in radio. Uses only two variometers, one honeycomb coil and single bulb. And brings them in on a loud-talker! The greatest hook-up of the year. All in the November issue.

PRINCIPAL ARTICLES TO APPEAR IN THE NOVEMBER ISSUE OF RADIO NEWS (AMATEUR NUMBER)

Vacuum Tubes for the Amateur, By Jesse Marsten.
The Autoplex Circuit, By M. L. Muhleman.
Loop Antennae for Transmission, By Allan R. Kenworthy.
100-Meter Continuous Wave Transmission, By S. R. Winters.
High Frequency Resistance, By D. R. Clemons.
My Moduloscope, By John L. Reinartz.
Design of an Audibility Meter, By Ralph R. Batcher, E.E.

Also articles by:
A. L. Groves,
Howard S. Pyle, Asst. U. S. Radio Inspector of the 8th Radio District.
Edward T. Jones.
Paul G. Watson.
Kenneth M. Swezey.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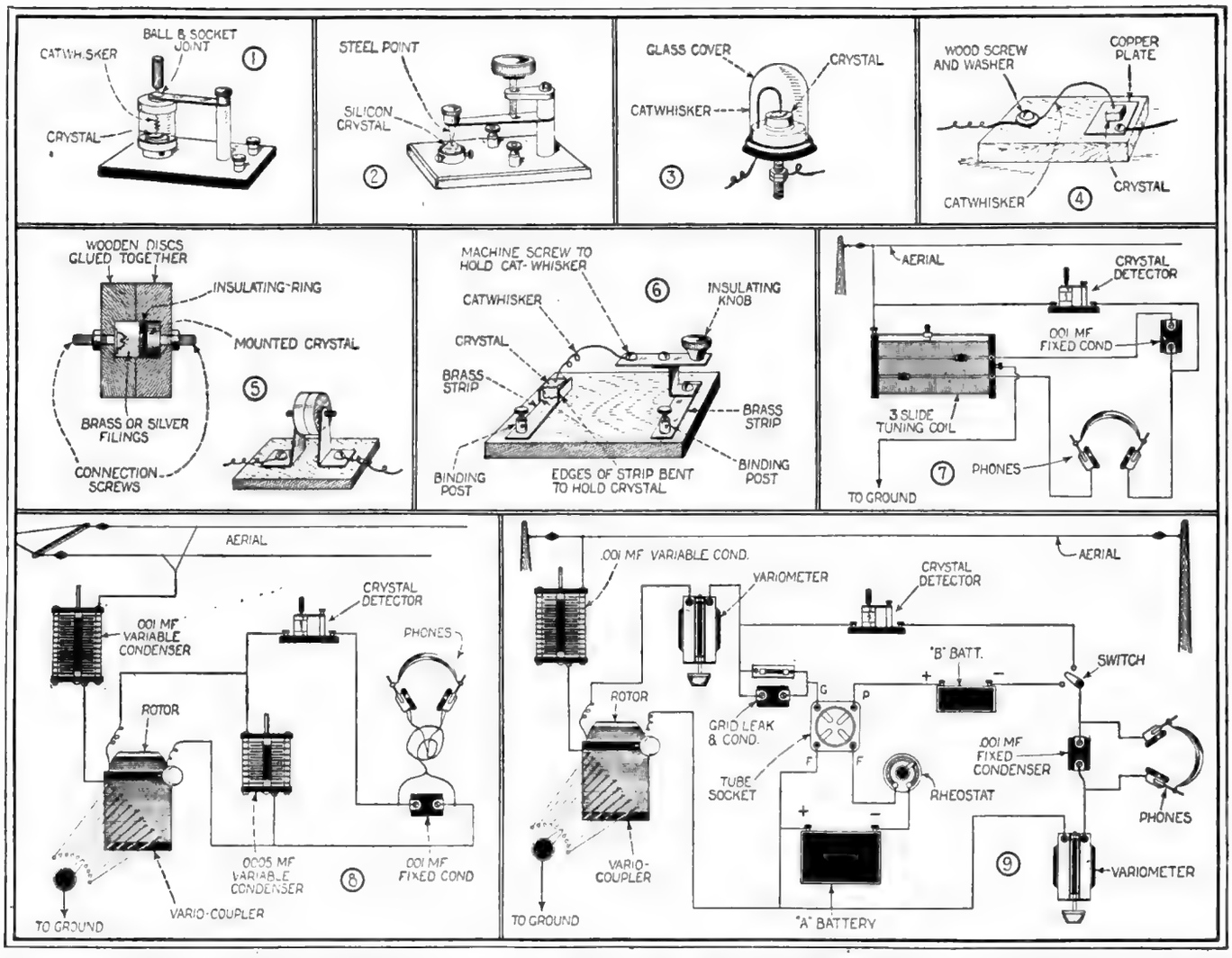
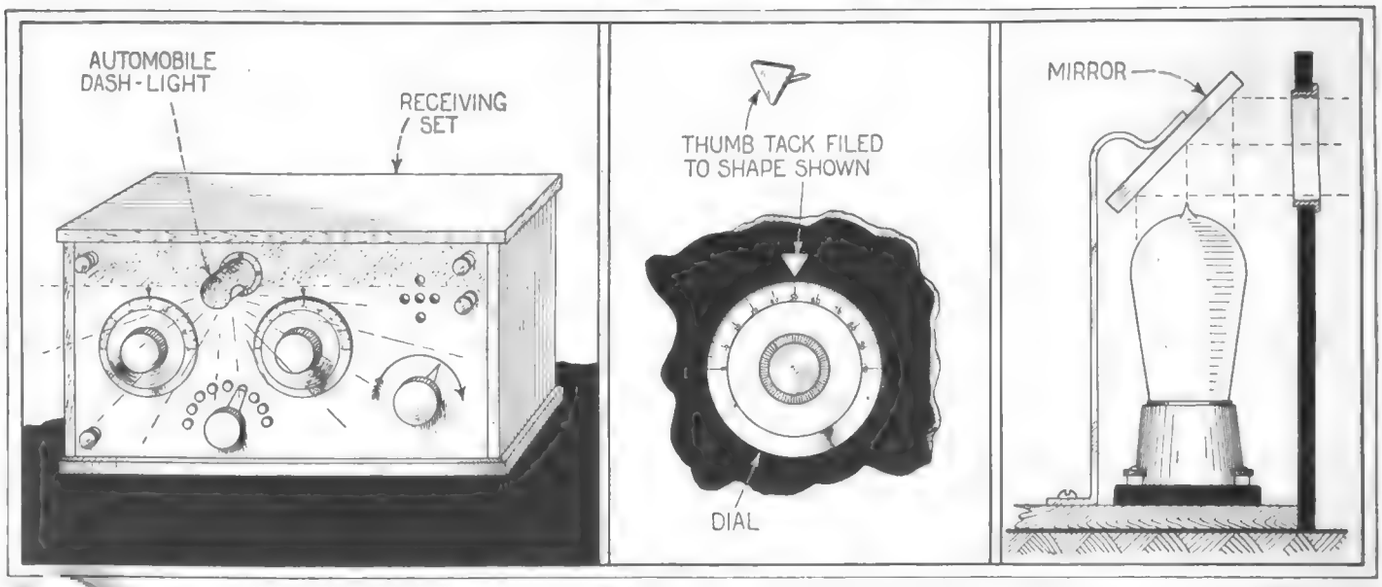
# Crystal Detectors

**By A. P. PECK**




**Figs. 1, 2 and 3 show various types of commercial crystal detectors. They also illustrate principles which should be followed in the construction of such apparatus. In Fig. 4 is illustrated one of the simplest crystal detectors which it is possible to make. Fig. 5 shows an enclosed crystal detector in which the cat-whisker is replaced by filings. In Fig. 6 is shown a crystal detector with a universal cat-whisker adjustment. A very selective circuit for use with a crystal detector is shown in Fig. 7. A crystal detector may be used with a variocoupler as shown in Fig. 8. By means of a two point switch, a crystal detector may be used with a standard short-wave regenerative tuner, when the vacuum tube detector is not used. Connections are shown in Fig. 9.**

# Three Handy Radio Wrinkles




**an automobile dashboard light on a radio receiving set as shown t set may be operated in a dark corner. This addition also saves g bills for "DX hounds." A novel indicator for dials may be made from a thumb tack as shown in the center above, according to Mrs. Luella B. Lyons. By using a mirror as shown at the extreme right, it is easy to ascertain whether a silvered bulb vacuum tube is lit.—H. W. S.**

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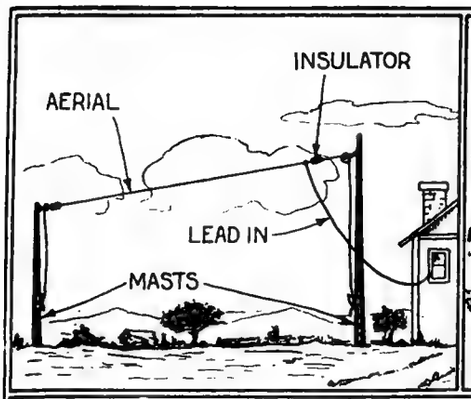
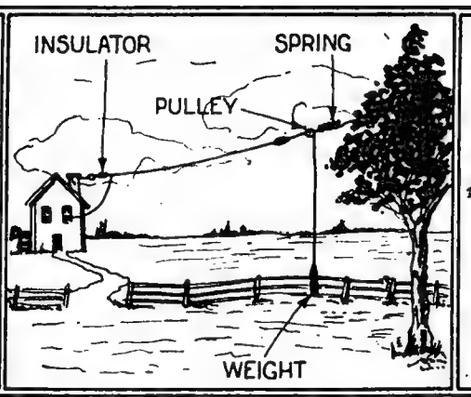
# Radio for the Beginner

## By ARMSTRONG PERRY

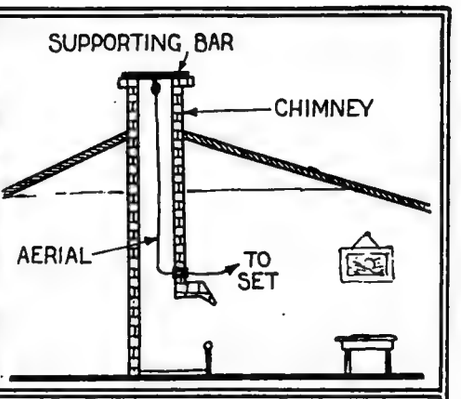
NO. 21—ONE WIRE AERIALS.



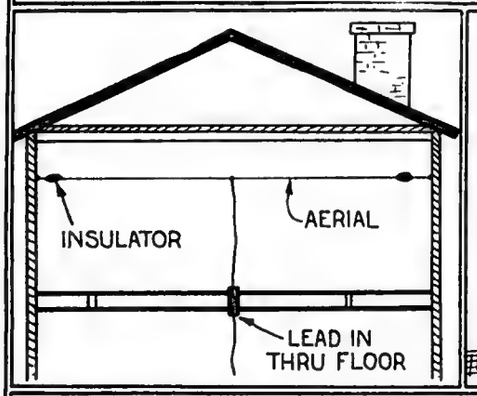

Where long poles are plentiful, it is a good idea to erect two masts, from 30 to 70 feet in height, and 80 to 150 feet apart.



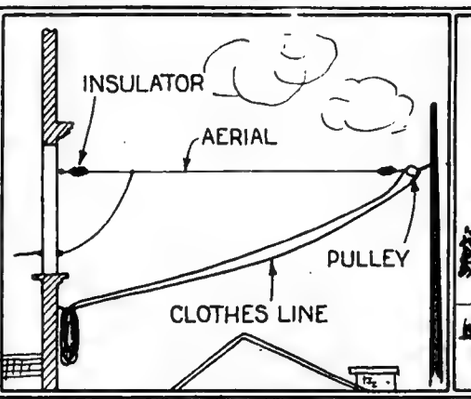

If one end of the aerial is fastened to a tree a heavy spring should be placed in the supporting rope or a weight and pulley used.



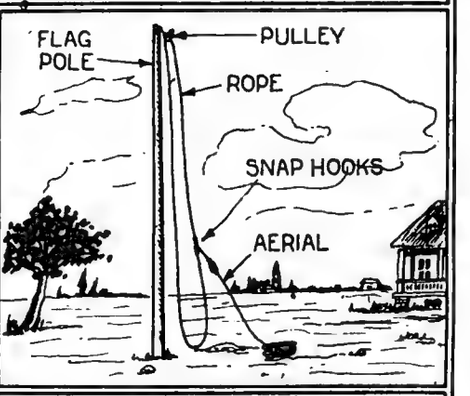

In a house equipped with an open fire place, an aerial may be strung in the chimney as illustrated above. This is fairly efficient.



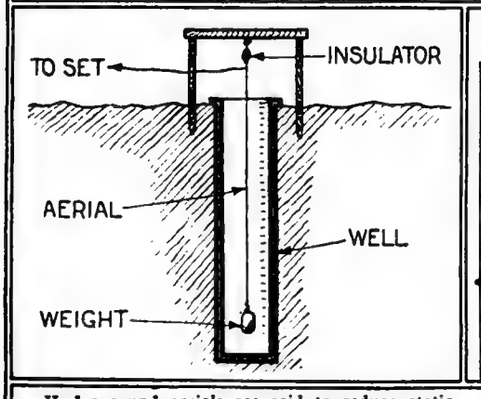

An aerial may be strung in the attic, and a lead-in taken off in the exact center as illustrated. Lead-in may come through the ceiling.



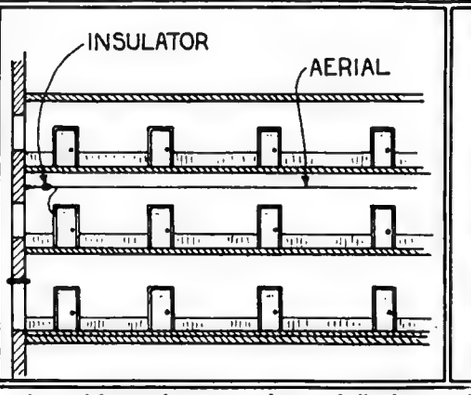

When an amateur lives in an apartment house, an aerial may be run out to a clothes pole as shown above.



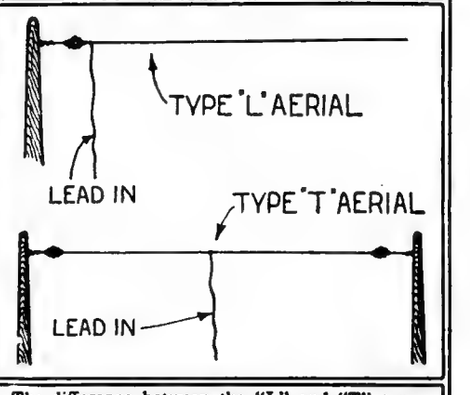

When the flag pole is not in use, an aerial may be run up by means of the rope as shown above. The other end may be fastened.



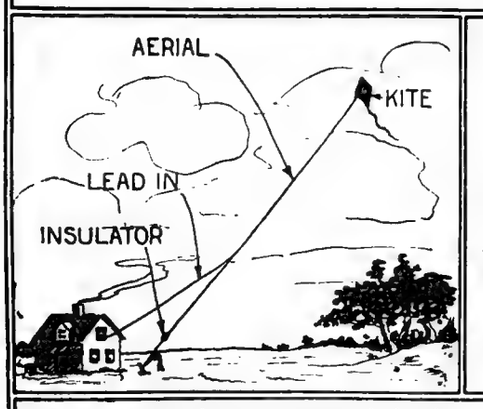

Underground aerials are said to reduce static to a great extent. The simplest way to make this aerial is to suspend it in well.



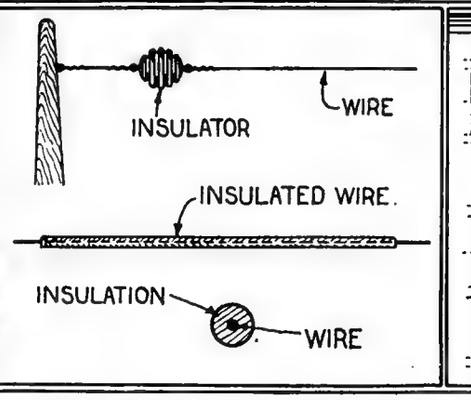

An aerial may be strung along a hall of an apartment and the lead-in brought through the door or woodwork. This gives good results.



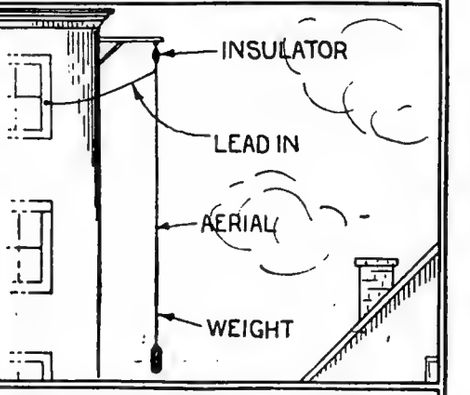

The difference between the "L" and "T" type aerials. In the latter the wave-length is equal to an "L" aerial twice the length.




During kite weather, a temporary single wire aerial may be raised with a large box or other type of kite. Note how insulator is used.




A method of insulating an antenna wire is shown in the upper part of the illustration while insulated wire is shown below.




From the upper floors of a tall building a vertical aerial may be made by dropping a wire out the window. If stormy, pull aerial in.

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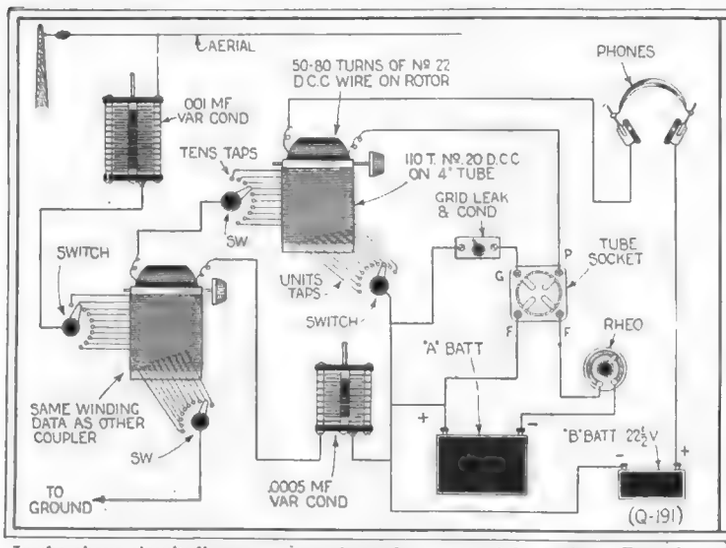
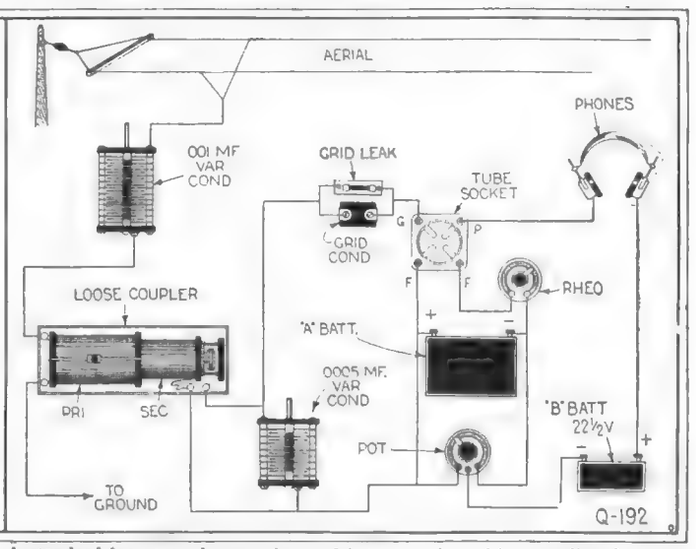
# Radio Oracle

**In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c is made for all questions where a personal answer is desired.**




In the above circuit diagram, two variocouplers are used for tuning. Exceedingly sharp results may be expected. Regeneration is accomplished through the rotor of the second coupler. The rotor of the first tuning coupler is wound the same as the rotor of the second.




A standard loose coupler may be used in connection with an audion detector, connecting up the instruments as illustrated above. Any size loose coupler may be used here, but if a very large one is employed, the resulting circuit may not be able to receive the shorter broadcasting wave-lengths.

## TWO-VARIOCOUPLER CIRCUIT

(191) James H. Alley, Waterville, Maine, requests of the Radio Oracle:

Q. 1. Can you give me a hook-up for two vario-couplers in connection with a vacuum tube?

A. 1. The required diagram will be found in these columns.

Q. 2. How should the vario-couplers be wound?

A. 2. This information is given on the diagram.

## LOOSE COUPLER WITH VACUUM TUBE

(192) Billy Arkin, Easton, Penn., requests:

Q. 1. What is the best circuit diagram for using a loose coupler and two variable condensers with a vacumn tube?

A. 1. The required diagram will be found in these columns.

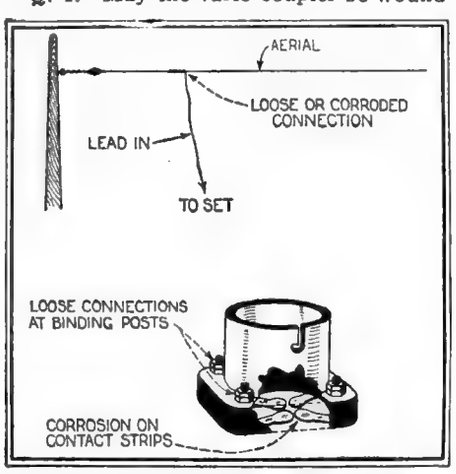
Q. 2. Would a potentiometer be of any assistance and how should it be connected?

A. 2. The instrument mentioned might aid somewhat in reception and connections for the same are shown on the diagram.

## SINGLE CIRCUIT TUNER

(193) F. H. Alderman, Ensign, Kansas, requests a circuit diagram of a single circuit tuner and asks:

Q. 1. May the vario-coupler be wound on a four inch tube and kindly give all data on the same?




Scratching noises and weak signals may very often be traced to loose or corroded connections. The two places illustrated above are very susceptible to such conditions. Query No. 195.

A. 1. The stator of a vario-coupler may be wound on the size tube you mention. Data is given in the illustration of a single circuit tuner to be found in these columns.

## A MAKE-SHIFT TUNER

(194) L. J. Denmire, Montrose, Iowa, requests:

Q. 1. How may I hook up a tapped tuning coil with two sets of taps, a variable condenser and a vacuum tube detector using an "A" battery potentiometer?

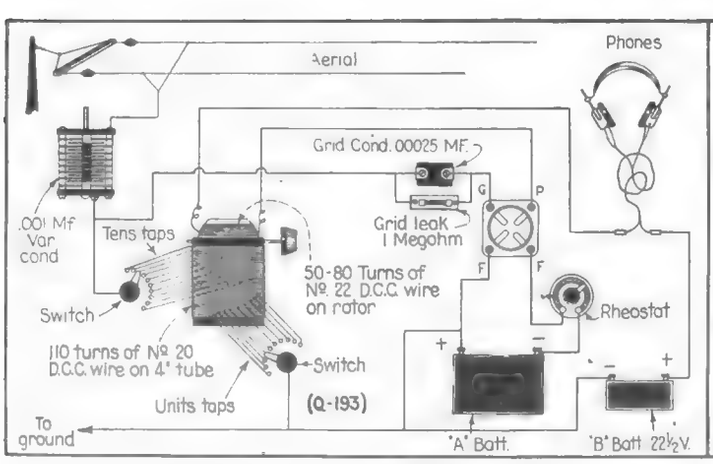
A. 1. The desired diagram will be found in these columns.

## SOURCES OF TROUBLE

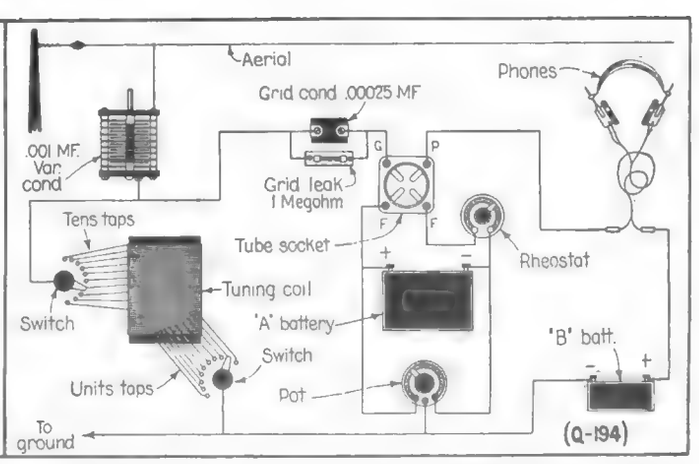
(195) A. R. Carter, Marfa, Texas, asks:

Q. 1. At times my signals become very weak, but not as in "fading," and scratching noises are heard. Can you suggest the cause?

A. 1. Loose connections at some point in your set are probably the cause. Two of the worst offending places are illustrated herewith.




The connections for the so-called standard single circuit tuner are shown above. The variocoupler may be wound as indicated or a standard type used. This circuit gives loud signals, but has little selectivity.




The tuning coil in the above circuit may be very readily wound, or the stator of a standard variocoupler may be employed. This circuit will not give very loud signals, but may be arranged in a compact portable form if desired.

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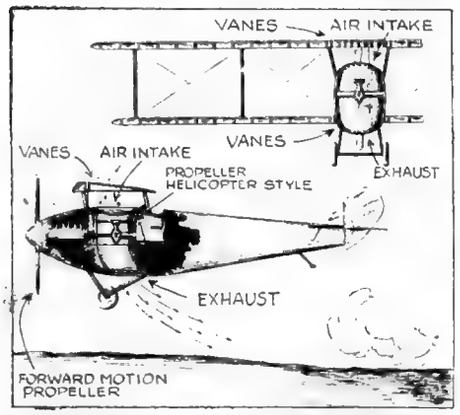
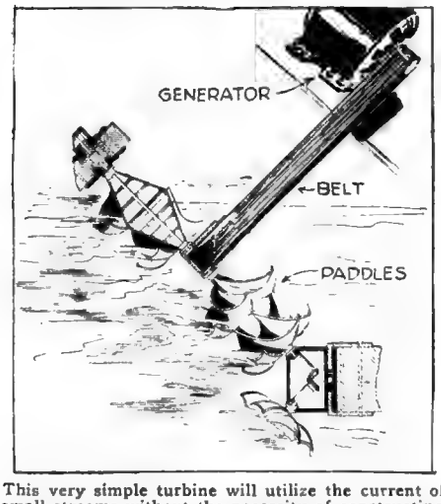
## Helicopter-Airplane



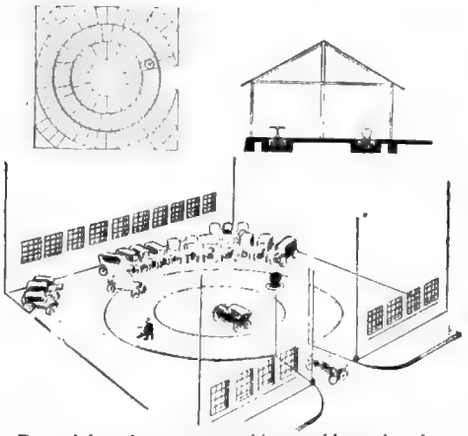

The helicopter idea is here applied to a more or less typical airplane. The vertical propeller is used only to assist in raising the machine from the ground. It is not used to keep the plane suspended while in flight. The vanes regulate the speed of rise.

## Water Turbine




This very simple turbine will utilize the current of small streams without the necessity of constructing costly dams and sluice-ways. The force of the current directly against the vanes turns the pulley, which is connected with an electric generator above.

## Garage System



For solving the garage parking problem, the above illustration shows a method where turn-tables are used. With their aid, a car may be placed on any part of the floor and can always be removed without disturbing the others.

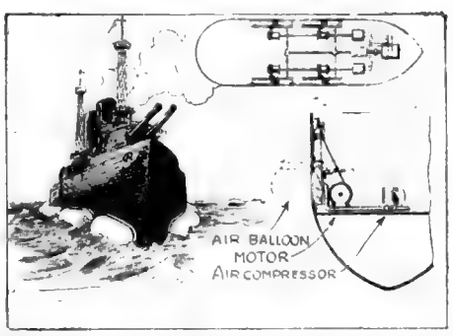
## Postman's Umbrella

Spare your pity for the postman in rainy weather now. This new umbrella (above) saves his uniform as well as his temper. Strapped to his back, it is out of the way. Instead of folding down, as usual, the top slides down the handle, making it take up the minimum space.

## Fly-paper Holder

This fly paper holder combines the maximum of adhesive surface with protection for individuals. The cup at the bottom keeps the adhesive from dripping and the ear on the top cup allows the whole thing to be hung up out of the way.

## Ship Pontoon

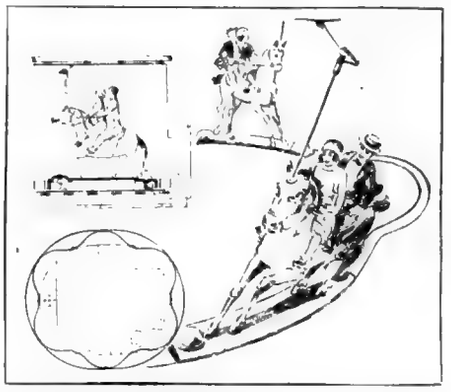



When a ship at sea equipped with this device is threatened with sinking, the motors are turned on and compressed air is run into the balloons fastened around the sides of the vessel. The balloons form pontoons which will keep the ship afloat.

## Wrist Vanity Case

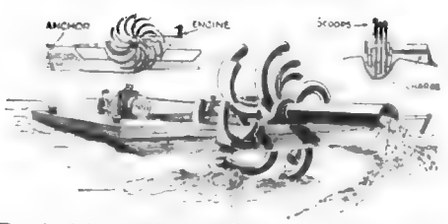
We have the wrist watch, why not the wrist mirror and the vanity case? Now comes an invention of the former. Strapped lightly with a chic black velvet ribbon to a lady's wrist, there is no need for men's pockets being cluttered with vanity cases.

## Amusement Device



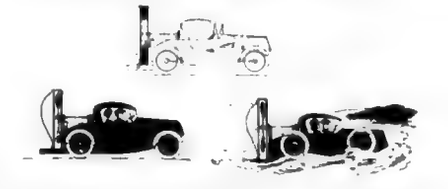
This new amusement ride is a combination of the old merry-go-round and the scenic railway. The horses are mounted on individual cars equipped with motors. The trolley feeding the current from above furnishes the necessary power for propulsion.

## Cable Dredge




For dredging small channels, for laying submarine cables and pipe, the machine shown above rotates the smaller pipes through the water, digging up the bottom. The water flushes the waste through the discharge pipe to removal conveyors.

## Amphibious Auto



The amphibious auto illustrated above goes from one element to the other with the minimum changes. On land the wheels propel the car. In the water the air screw is turned on and pushes the erstwhile auto to the other shore.

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# Scientific Humor

**Applied Astronomy.**—SOUTHERN PLANTER: "Why, Mammy, what ails you?"

MAMMY ROSE: Lawdy, Boss, Ah's a-rackin' wid de Sci'ntific rheumaticks."

SOUTHERN PLANTER: "Sciatic rheumatism, eh? Now that's too bad, sure."

MAMMY ROSE: "Dis is *Sci-ntific* rheumaticks, Boss, Ah shore does sees stahs."—*Marion Jones.*

**One Good Turn Deserves Another.**—LITTLE ARTHUR: "Isn't it an eclipse of the sun, Mama, when the day is turned into night?"

MAMMA (not much of an astronomer): "Yes, dear, certainly."

LITTLE ARTHUR: "Then what is an eclipse of the moon?"

MAMMA: "The moon? Oh, when the night is turned into day, of course.—*Henry Wachulski.*

**The Hospital Was Hospitable.** — RASTUS: Ah sittinly is glad to see yo' out of dat horspittle, Sam. What done happen to yo' in dar?

SAMBO: "Ah done had ma bones X-rayed. "An' Ah bets a five-spot dey was loaded.—*Judge.*

**Dum, Head Over Heels.**—LINEMAN: "Say young fellow, don't stand on that bare wire, you are liable to get a shock."

SMART ALECK: "That's all right, I wear rubber heels that absorb the shocks."—*Peter Horwot, Jr.*

**He Panted Painfully.**—FIRST CHEMISTRY STUDENT: "What did you do in the laboratory today?"

SECOND CHEMISTRY STUDENT: "We were experimenting on hydrochloric acid."

F. C. S.: "What results did you get?"

S. C. S.: "Two holes in my pants and a bad headache."—*Peter P. Udre.*

**A "Loud" Speaker.**—"Paw, what is a telephone amplifier?"

"That, my son, is one of those saps who grins into the transmitter and makes gestures while he's carrying on a phone conversation."—*Judge.*

**The Right "Spirit."**—FIRST STUDENT (In Chemistry Class): "What is the method used for the formation of alcohol?"

SECOND STUDENT: "Nothing doing, old chap. I had an uncle who once told a stranger the method he used, and the next day he found out that the fellow was a prohibition agent."—*Keeling Adams.*

**It'll Work 'Ether' Way.**—A. BROAD: "I have just read that doctors are going to discard the old method of putting their patients to sleep while operating on them, and have then listen to radio concerts instead. What do you think of the idea?"

CASS STER: "Well, it may please some, but for me, I would prefer my ether straight."—*Keeling Adams.*

## First Prize $3.00

**Wire You Insulate!**—PROFESSOR: "James what is used to conduct electricity?"

JAMES: "Why 'er. . .

PROFESSOR: "Correct. What is the unit of electric power?"

JAMES: "The what? sir."

PROFESSOR: "Correct. What is the unit of resistance?"

JAMES: "Oh-um . . .

PROFESSOR: "Correct. You may take your seat."—*James W. Allen.*

**Succor for the Sucker!**—TEACHER IN SCIENCE: "Johnny, what is the principle of drinking through a straw?"

JOHNNY: "Seeing how quick you can get a chocolate soda from the glass into your mouth.—*Hartridge Miller.*

*WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. No letters acknowledged unless postage is included.*

*All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to "tie" for the prize, then the sum of three dollars in cash will be paid to each one.*

**Yes, But Power Plants Give "Currents."**—An electrical expert was visiting the country and, while passing a farm saw an old farmer burying what looked to him to be perfectly good dry cells.

The electrician asked the meaning of this sheer waste and the farmer answered:

"I've had good luck with nearly every kind of plant in this soil, so I thought I'd bury these batteries and grow a power plant."—*George Panter.*

**He Made Her See Stars!**—JOHN: "Hello, Jim, you look pretty mad today."

JIM: "You bet I'm mad."

JOHN: "What happened?"

JIM: "Well, I had a telescope and my wife wanted to use it. She took a can-opener and broke the top right off it."—*Alfred Stawarz.*

**Practical Astronomy.**—GRECIAN MAID: "Professor, why is it that you see more shooting stars on a warm summer night than at any other time?"

PROFESSOR ARISTOTLE: "Because you sit out more on those nights.—*Vanderbilt Jade.*

**Quite Simple.**—THE DOCTOR (to patient): "You go to your druggist and ask him for some iodhydrargyrate of iodide of potassium, some ankydroglucochloral and some dioxyamidoarseno-benzol—and I should not be surprised if with those we shall be able to triumph over your loss of memory.—*Le Journal Amusant (Paris).*

**He Wasn't Grounded.**—"Do you keep your ear to the ground?"

"Not now," said Congressman Swayback. "I gotta radio outfit."—*Louisville Courier-Journal.*

**Hope He Doesn't Get Hula Hella!**—I joined the multitude. I became a radiophan.

While receiving one night the phone rang. It was the wife.

"Are you getting anything to-night?"

"Yes, I am getting some very fine Hawaiian right now—"

"Aw Dear," she said, "don't joke, you know you can't reach that far."—*J. W. Schoonmaker.*

**Polite to the Last**—WARDEN (to murderer in electric chair)—"Is there anything you would like to do or say before I push the fatal button?"

THOUGHTFUL MURDERER—"Yes, kind sir, I would like to get up and give my seat to a lady."—*Punch Bowl.*

**Some Nerve**—"Tell me, doctor," said the patient in the hospital, nervously, "is there any chance of this operation proving fatal?"

"Really, young man," protested the doctor, haughtily, "considering that we are experimenting on you free of charge, I think your curiosity is hardly good form."

—*Tit Bits (London)*

**"Over" Her Head.** — The younger generation of the Smith family had been exposed to the "radio bug" and received a bad case of it.

The family went outside to select the best place for the aerial, closely followed by Mrs. Smith. They all agreed on a tall 2½ story barn as the most suitable place.

"What?" asked Mrs. Smith, astounded, "you're going to put it up there?!!"

"Why sure mother," answered one of the sons, "that's the best place for it."

"Well!" she replied, scornfully, "*you* might be big enough fools to climb up there and listen, but you'll never catch *me* doing it."—*Gretchen Dorner.*

**We Should Re-fuse This Joke.**—"What is the Load-Factor of your Ohm-Brew?"

"About 7%, but it doesn't Phase me.—*I. L. Henderson.*

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# THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

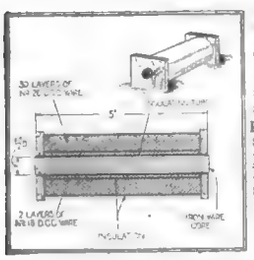
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to the department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such quesions are answered.

## TELEPHONE INDUCTION COIL

(1564) Stuart D. Pike, Holden, Mass., asks:

Q. 1. How can I make an induction or repeating coil similar to that used in telephone circuits?

A. 1. You may make an induction coil similar to that used in a telephone as follows On a core composed of a bundle of iron wires one-half inch in diameter by five inches long, wind two layers of No. 18 D. C. C. wire. After insulating this winding with oiled silk or oiled paper, wind thirty layers of No. 20 S. C. C. wire thereon. The former is the primary, the latter the secondary.



**The sketch shows the construction of a small induction coil, such as used in telephone work and sometimes called "repeating coils." A layer of insulation should separate the two coils.**

## STORAGE BATTERY PLATE PASTE

(1565) Charles Petrie, Canada, refers to an item in the Oracle Department in May 1923 issue, on paste for storage battery plates and asks:

Q. 1. Why is barium sulphate and ammonium sulphate used in mixing the paste for the plates?

A. 1. The two chemicals you mention are used in making up the paste for storage battery plates so that the filling will not crumble and fall out of the spaces in the plates. A very small amount of both is all that is necessary, probably 1-20th of the amount of active material, that is litharge or red lead.

## DYNAMIC BRAKING SYSTEM

(1566) Raymond W. Platt, Akron, Ohio, says that he has successfully used a dynamic braking system on a D. C. motor and asks:

Q. 1. Can this same system be used on an A. C. motor?

A. 1. It would not be wise to use the brake system that you mention on an A. C. motor as is done on a D. C. motor. Such a system would, undoubtedly, be very damaging to the former.

## AMPERAGE OF LIGHTS

(1567) H. H. Parker, Oakland, Calif., asks:

Q. 1. What is the approximate amperage of the ordinary string of Christmas tree lights rated at 14 volts each with eight in series to be used on a 110 volt circuit?

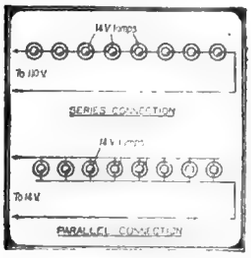
A. 1. The amperage drawn is about one-fourth of an ampere.

Q. 2. What would these lamps draw in amperage if they were connected in parallel?

A. 2. If eight of them were connected in parallel they would draw approximately two amperes at fourteen volts.

Q. 3. I wish to design a step-down transformer to light these bulbs in parallel. How should I design the secondary.

A. 3. We would advise you to design your transformer to deliver fourteen volts and three amperes on the secondary side to allow for all losses.




**To the left is shown the method of connecting ordinary Christmas tree lights in parallel and also in series. The series connection will work directly on 110 volt lighting mains.**

## STAGE SMOKE

(1568) F. W. Puhl, Washington, D. C., asks:

Q. 1. What combination of chemicals should I use to produce great quantities of dense white smoke for stage work, without any violent chemical action whatsoever?

A. 1. If the fumes arising from ammonia be allowed to mingle with those of hydrochloric acid, the result will be dense clouds of white smoke. No violent chemical action will occur. This is probably the very best way to produce the result you desire. If a solid and a liquid be of such composition that when brought into contact with each other they will produce clouds of smoke, there will almost invariably be violent chemical action.

## ELECTRICAL WELDING

(1569) Jorge Rodriguez, San Pedro, Cuba, wants to know:

Q. 1. How should the polarities of an electric lighting circuit be connected when used for welding?


**ELECTRICITY?**

HOW many ways do you know in which electricity can be produced? If you are a radio man or are interested in radio, you should know ALL the methods as to how this mysterious force can be produced. There are 8 little known methods that will surprise you. It will probably help you in your work.

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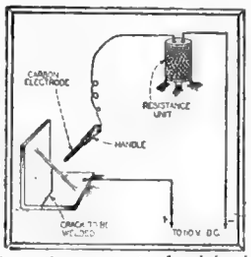
**Highly Interesting Articles to Appear in November Issue of Practical Electrics**

ELECTRO VENTRILOQUISM
PERFECTED X-RAY INSTALLATION
HIGH TEMPERATURE RESISTANCE FURNACE By Allan P. Kenworthy
THERMIC TELEPHONES (Concluded)
DARK OR BLACK LIGHTNING By Ferdinand Ellerman
MERCURY VAPOR ARCS
LITTLE KNOWN METHODS OF PRODUCING ELECTRICITY By Raymond B. Wailes


A. 1. If you use direct current for welding, the positive side should be connected to the work, and the carbon rod to the negative side. If alternating current is used, of course, it will not be necessary to discriminate, as the polarity is constantly changing.

Q. 2. What precautions must be used in electric welding?




**Here is shown the method used in connecting the carbon and the work for welding with electricity. When using direct current always connect the work to the positive side.**

A. 2. In all welding, the parts to be joined should be perfectly clean. The methods of welding various kinds of iron differs with the composition of the same, and whether it is cast or malleable. In any case, aluminum is very difficult to solder, and special preparations and precautions are necessary. This subject is so broad that we would advise you to purchase one or more books on the subject.

## ASBESTOS CEMENT

(1570) Will Stone, South Bend, Ind., asks:

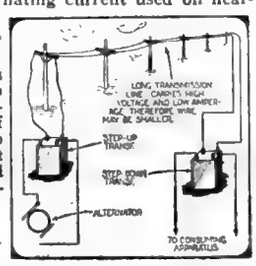
Q. 1. How may I fasten sheet asbestos securely to steam pipes?

A. 1. Make a thick paste of ground asbestos mixed with a solution of sodium silicate. After the two substances have been thoroughly mixed, add a small amount of calcium chloride. This will make the cement insoluble after it has once set.

## COMMERCIAL USE OF A. C.

(1571) G. Orville Pyle, Belair, Md., asks:

Q. 1. Why is alternating current used on nearly all commercial electrical lighting systems instead of direct current?


LONG TRANSMISSION LINE CARRIES HIGH VOLTAGE AND LOW AMPERAGE, THEREFORE WIRE MAY BE SMALLER
STEP-UP TRANSF.
STEP-DOWN TRANS.
ALTERNATOR
TO CONSUMING APPARATUS

**Alternating current is used commercially to a great extent because it lends itself to transformation so easily. At the right is shown a simplified diagram of a transmission line.**

A. 1. Alternating current is better adapted to long distance transmission purposes because it can be transformed very easily to high potentials, resulting in lower current values, and smaller conductors.

## DISSOLVING NITRATE OF SILVER

(1572) W. J. Pettigrew, Raidsville, N. C., wants to know:

Q. 1. Can nitrate of silver be dissolved in alcohol so that it can be spread over a plate surface?

A. 1. Nitrate of silver may be dissolved in either water or alcohol.

## ELECTRIC BELTS.

(1573) G. L. Rasnuissen, San Francisco, Calif., requests:

Q. 1. Can you give me information on how to make an electric belt for curing rheumatism?

A. 1. Medical science has proven that the so-called electric belts are a fraud. Therefore, we cannot give you any data on the construction of one which will cure rheumatism.

## THE THERMOPHONE AND RECTIFIER SOLUTIONS

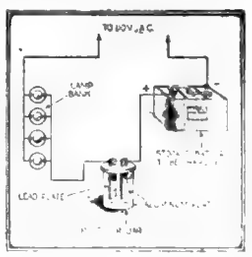
(1574) F. P. Ronnan, Halifax, N. S., Canada, wants to know:

Q. 1. Is not the principle of the thermophone telephone receiver based upon the variations of heat in a wire?

A. 1. The principle of the thermophone is based upon the variations of heat in a fine resistance wire, which gives rise to vibrations in the atmosphere which correspond with the voice spoken in the transmitter.

Q. 2. What solutions may be used in an electrolytic rectifier?

A. 2. The following solutions may be used in an electrolytic rectifier. A saturated solution of sodium phosphate, a saturated solution of bicarbonate of soda, a 10 percent solution of sulphuric acid, or a 10 per cent solution of hydrochloric acid. A strong solution of ordinary brine will also give satisfaction.




**A wiring diagram for connecting an electrolytic rectifier to a lighting circuit for charging a storage battery is shown here. The series parallel lamp bank controls amperages.**

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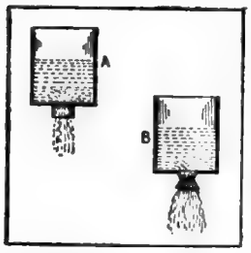
## VENTURI ACTION

(1575) Walter S. Camp, Long Valley, N. J., asks:

Q. 1. What is meant by a Venturi opening




**At the left is illustrated the Venturi shaped opening. The peculiarity of this tube is that it admits a greater flow per unit time than a plain opening of similar size. It is used in carburetors for greater admittance of air.**

and of what value is it in a gasoline engine carburetor?

A. 1. The Venturi action which you mention is illustrated here. We have two pails of water, one with a circular one-inch opening cut in the bottom in the ordinary manner, but the other, with the same sized opening, has a Venturi-shaped tube secured to the one-inch hole. If each vessel is filled with an equal quantity of water, it will be found that vessel B will empty itself before vessel A, due to the peculiar action of the Venturi tube. The drawing shows the shape of a Venturi tube.

This action is taken advantage of in automobile or gasoline engine carburetors around the spray nozzle in the mixing chamber where the gasoline vapor and air are mixed. The purpose of such an opening in the spray nozzle is to obtain a greater volume of air through a certain size hole in a shorter period of time.

## HAIR TONIC

(1576) C. L. Swain, Hayden, Ariz., wants to know:

Q. 1. Can you give me a hair tonic which will stop dandruff and falling hair?

A. 1. We are giving you herewith the formula for making a hair tonic such as you request. It should be used for the first time after the hair has been thoroughly shampooed.

Salicylic acid, 1 part.
Precipitated sulphur, 2½ parts.
Rose water, 25 parts.

This is to be applied every night for a week, whereupon the hair is again shampooed. Usually such applications continued in this rotation for a period of six weeks will completely check falling hair and eliminate dandruff. After this treatment the shampoo should be taken less frequently.

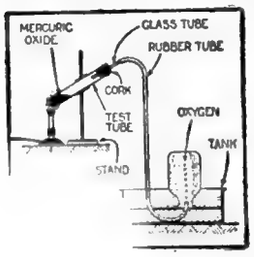
## OBTAINING OXYGEN

(1577) Stephen E. Cerva, Latrobe, Pa., asks:

Q. 1. How can oxygen be obtained from mercuric oxide?

A. 1. Regarding the obtaining of oxygen from mercuric oxide, we would advise you to set up the apparatus as illustrated. The jar for the oxygen should be filled with water and a glass plate or the hand placed over its mouth. It should then be inverted with the mouth below the surface of the water, and the hand or glass plate is removed. Do not place the mouth of the jar over the rubber tube as yet. Now gently heat the test tube containing the mercuric oxide, while the open end of the rubber tube is kept below the surface of the water. Bubbles will pass out from the tube and after they have done so for a few seconds, place the jar, still full of water, over the end of the tube. The jar will then become filled with oxygen by displacement of the water. Do not at any time remove the heat from the test tube while the open end of the rubber tube is under water, otherwise, upon the cooling of the air in the test tube, a partial vacuum will be formed and water will be drawn back up the tube into the test tube. After obtaining a jar full of oxygen, leave it in the water with its mouth downward. Remove the rubber tube from the water, whereupon the flame heating the test tube may be extinguished. It will probably be necessary to hold it down to prevent it from turning over. Now light a splinter of wood with a match, and blow it out so that the end is only allowed to glow. Quickly take the jar of oxygen from the tank and insert the glowing splinter into the mouth of the jar. It will burst into flame, indicating the presence of oxygen.

After heating for a considerable length of time, the mercuric oxide will become a dull gray color. By exposing to the air, it will again reach its normal red color. It can then be used over again for performing the above experiment.




**The set-up of apparatus for obtaining oxygen from mercuric oxide. After each batch of oxygen is drawn off by heat the residue may be exposed to the air, whereupon it will absorb oxygen therefrom and the experiment may be repeated.**

## TESTING ARMATURES

(1578) Geo. W. Ross, Huntington Park, Cal., wants to know:

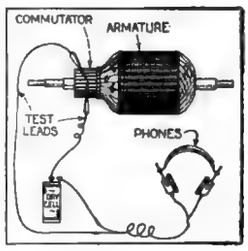
Q. 1. How can armature coils be tested, using a telephone receiver and a dry cell?

A. 1. To test out armature coils with a telephone receiver, merely connect one side of the receiver to a dry cell, and with the other lead from the receiver and the dry cell, go from bar to bar of the commutator. If a click is heard, the coil is O. K.; if not, the circuit is open.

Q. 2. Is this method as good as the growler method of testing armatures?

A. 2. This method is not as good as the growler method, inasmuch as the latter indicates whether any of the turns in the coil are "shorted." This is determined by the loudness of the sounds heard in the receiver, which is used in connection with the growler.

**In testing armatures with a dry cell and telephone receiver, the simple hook-up shown at the right is used. If a loud click is heard after the connection is made at the commutator the armature coil is in good condition. If not, it is open.**





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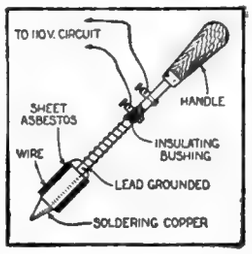
## ELECTRIC SOLDERING IRON

(1579) A. A. Sadler, Bowie, Texas, asks:

Q. 1. Will you kindly give me data on the construction of an electric soldering iron to be used on 110 volts A. C.?

A. 1. The required data will be found in the accompanying illustration.




**A home-made electric soldering iron is illustrated in the drawing to the left. One side of the winding should be grounded to the handle of the iron. The resistance of the wires allows the iron to be directly connected to a lighting circuit.**

## BAKELITE

(1580) Joseph J. Schwab, Columbus, Miss., wants to know:

Q. 1. Would it be possible for an amateur to compound a substance such as bakelite for use in making radio panels?

A. 1. Materials similar to bakelite and celeron are so difficult in details of preparation that it is practically impossible for the amateur to make them at home. Their manufacture is so complicated that it would by no means be worth while for you to attempt to make such materials.

## "SPIRIT" WRITING

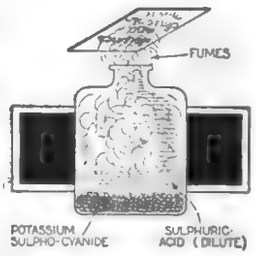
(1581) L. Nichols, Duluth, Minn., says that he has seen a so-called fortune teller expose a piece of paper to the fumes arising from a jar, whereupon writing appears upon the paper. He asks:

Q. 1. Can you tell me how this is accomplished?

A. 1. The "spirit" writing which you mention may be done as follows:

Write the message with a very weak acid solution of iron (ferric) chloride. This solution must be so weak that when written with, the writing will be invisible when dry. If paper written upon

**Here is illustrated one method of "spirit" writing. The writing is done with a weak solution of ferric chloride. When it dries it is subjected to the fumes of sulphuric acid acting on potassium sulphocyanide which makes the writing visible.**




with this ink is subjected to a vapor arising from the action of sulphuric acid on potassium sulphocyanide, the writing will become visible, taking on a red color. It will then disappear if subjected to the fumes of ammonia and may alternately be made to appear and reappear by means of these two vapors.

Another method is as follows: Sulphate of copper in a very dilute solution will produce an invisible writing which may be turned to a light blue color by exposing to the vapor of ammonia. The paper may be written on with lead acetate solution and exposed to sulphuretted hydrogen gas, the latter generated by the action of dilute sulphuric acid of iron sulphide. Use as little as possible as the odor is that of rotten eggs.

## TANNING HIDES

(1582) H. L. Roady, Sunnyside, Wash., asks:

Q. 1. Can you give me the necessary information for tanning cow hides?

A. 1. We are giving you herewith the information on tanning hides as requested by you.

The hides are soaked in a solution of sodium carbonate of 10° Bé for three to six hours. After washing with water they are allowed to remain for five hours in a bath of caustic soda, the strength of which may vary from 2° to 30° Bé. From this they are transferred to a bath of hydrochloric acid (1 to 5° Bé) in which they remain for two hours. Finally the hides are washed and the hair removed. The tannage consists of a special bath of sodium or ammonium sulphoricinoleate (2 to 30 per cent) and sumac extract. The strength of this bath is gradually raised from 4° to 30° or 40° Bé.

## AVIATION PROBLEM

(1583) Robert W. Spicer, Lexington, Ky., presents a problem as follows:

"An observer in a balloon measures the angle of depression of an object on the ground and finds it to be 63 degrees 58 minutes. After descending vertically for 582 feet he finds the angle of depression of the same object to be 74 degrees 49 minutes. From these he is to calculate his height in the air." He asks:

Q. 1. Would the pilot ever encounter any such problem under actual flying conditions?

A. 1. The modern pilot of a balloon does not encounter such a problem as you mention for the simple reason that he uses an aneroid barometer to calculate his height above sea level. This is an instrument which will be found described in any physics text-book and which indicates the atmospheric pressure encountered at any given point. This instrument is checked up continuously and corresponds with the standard instrument on the ground and all calculations are made to account for changes in atmospheric pressure due to storms and for other reasons.

Of course, however, your trigonometrical problem is very simple. All the angles and one side of the upper triangle are known, as shown herewith. Therefore, the length of side A can be calculated, and with this data side B can be determined.

**The problem of the balloonist illustrated here is one of simple trigonometry. Two of the angles of the triangle are known as well as the length of one of the sides, so the solution involves the sines and cosines of the known angles.**

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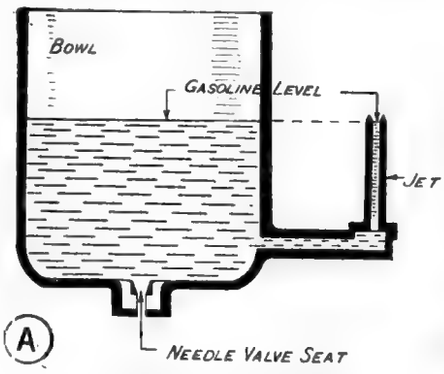
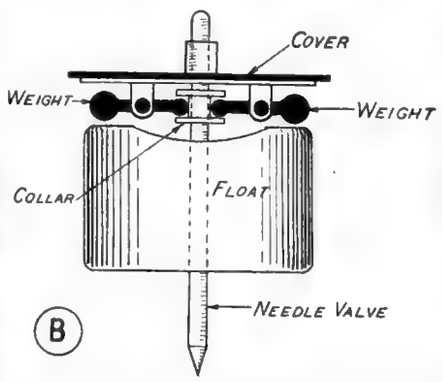
## Motor Hints

### Carburetor Action Explained

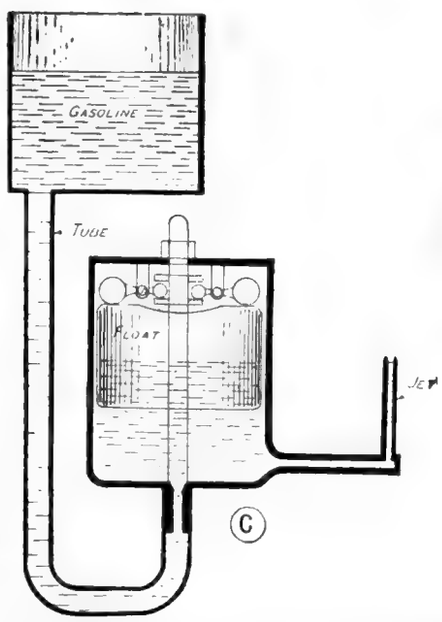
By TOM C. PLUMRIDGE




An essential part of good carburetting is a correct gasoline level. Sketch "A" shows the correct level. The gasoline level should be just below the top of the jet.




Sketch "B" shows the controlling unit of the gasoline level. As the level drops, the float does also. The weights will also descend and they in turn raise the needle valve, allowing more gasoline to flow into the bowl. To lower the gasoline level, the needle must be lengthened below the collar. This can be accomplished by resting the collar on something solid, and lightly tapping the top of the needle. If the gasoline level needs raising, reverse the process.




To correctly check the gasoline level some arrangement must be made so that there is a good pressure of gasoline in the float bowl and also to allow the jet to be seen. Sketch "C" shows a very easy and satisfactory method of checking this level. In most carburetors it is possible to remove the body so that it leaves the jet exposed. In [illegible] the removal of the butterfly valve will [illegible] mination.

(Continued on page 688)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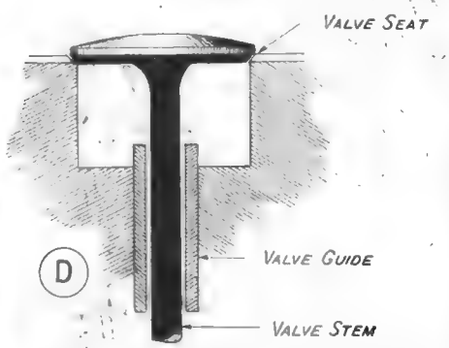
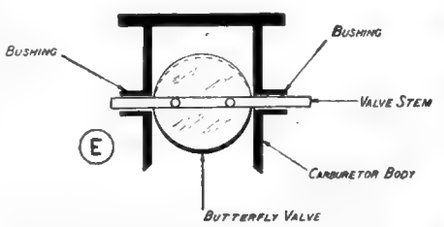
# Motor Hints

## CARBURETOR ACTION EXPLAINED

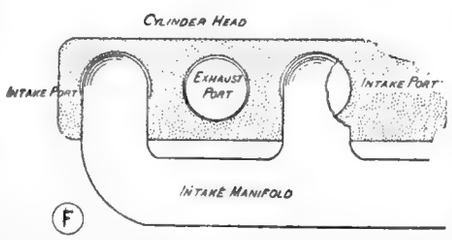
(Continued from page 686)




Air leakage is found in worn intake valve guides and valve stems. On the down stroke of the piston air is drawn into the combustion chamber through the space between the valve stem and the valve guide. This impoverishes the mixture and will cause spitting through the carburetor because of lean mixture. Guide or stem should be renewed. Sometimes it is necessary to renew both before this trouble can be cured. Oversize valve stems often cure it.




Air leaks also are found at the point where the butterfly valve stem passes through the body of the carburetor. This has the same effect as worn valve stem and guide. Renewal of the bushings and butterfly valve stem will cure the trouble at this point.




After a short while the gaskets between the intake manifold and cylinder block will compress. Unless carefully examined the air leak at this point will escape detection. A good test is to squirt gasoline around the joint and see if there is any difference in engine operation when this is done.

### IN REFERENCE TO "PHONOGRAPH EVOLUTION"

It may be that some readers received erroneous impression from the article entitled "Phonograph Evolution," appearing in the August issue of this magazine. The first phonograph for recording and reproducing sounds by means of a wax record such as is used today on dictaphones was patented in 1886 by Chinchester A. Bell and Sumner Tainter. This was the first commercially practical machine. The experimental work done by Thomas A. Edison in 1878 was carried out on machines using tin-foil as the recording medium. This machine was not used commercially, but gave quite satisfactory results, which resulted in hundreds of press notices at the time and in many exhibitions of the apparatus. A complete account of the wonder which was expressed by the people of this country to Edison's first phonograph will be found in the volumes entitled "Edison's Inventions."

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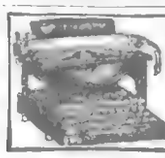

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# Book Review

## ELECTRIC FURNACES IN THE IRON AND STEEL INDUSTRY. Fully illustrated. Hard covers, size 5½"x9". Published by John Wiley & Sons, Inc., New York City.

Three authors unite in the production of this treatise, a German, an Austrian, and a representative of American metallurgy. The electric furnace, it is not too much to say, is revolutionizing metallurgy. For a long time it was devoted to a special line of work, such as the manufacture of aluminum alloys, abrasives, and other specialties, but now it is coming into the great field of the metallurgy of steel, and it already is doing a vast amount of work in that division of the science of metallurgy. By the induction furnace a metal can be melted without coming in contact with the fuel. Again a furnace of comparatively small dimensions can be worked economically, so as to do the work, which in old times required a great blast furnace. Sweden, almost a coalless country, depends largely on the electric furnace for its metallurgical work. Norway is in the same position, and both of them are using year by year, more and more of their great hydraulic powers. So it is not too much to say that the revolutionizing of the field of metallurgy is in active progress now, and this book describes the present aspect of the movement.

## LETTERS OF A RADIO ENGINEER TO HIS SON. By John Mills. Profusely illustrated. Hard covers, size 5½"x8¼". Published by Harcourt, Brace and Co., New York City.

This is a very nice presentation in book form of the elements of wireless engineering. The readers of our columns have followed the progress of the wireless art from step to step, and many of them have gleaned from the columns of *Radio News* practically all the interesting matter which has evolved in the science up to date, and here we have a resumé of the science, which while supposed to be addressed to young people, takes cognizance of the fact that the young person of the present day is a very serious proposition, and the books written for him have to be correct.

## DIE AQUARIENKUNDE. By Dr. E. Bade. Fully illustrated. Paper covers, size 6"x9¼". Published by Creutzische Verlagsbuchhandlung, Magdeburg, Germany.

Dr. Bade is an old time contributor to the columns of SCIENCE AND INVENTION. We have been honored by his interesting articles presenting natural history in its various phases in popular and attractive style to our readers. In this book the author goes deeply into the subject of the aquarium, the art of the construction and of the care thereof. The German publishers of books of this type have the art of making them wonderfully interesting by the illustrations. They seem to get at the root of things better than the publishers of other nations, and this book is most interestingly illustrated with the appliances of the aquarium, and with numerous half tone illustrations of its inhabitants. Two very beautiful color plates, one on the cover, and the other facing the title page, make one wish that there were more. The book is well worth an index, which we regret to say is missing, but the table of contents is so good that the index is hardly needed. Many of the illustrations are from the matchless hand of Dr. Bade. The book is in its fourth and fifth editions.

## A SHORT COURSE IN THE TESTING OF ELECTRICAL MACHINERY. By J. H. Morecroft, E.E., and F. W. Hehre, E.E. 111 illustrations. Hard covers, size 5½"x8¾". Published by D. Van Nostrand Co., New York City.

The title of this book expresses its contents. In it there is described in full detail the testing of electrical machinery, which while stated to be for non-electrical students like many other alleged elementary books, is so well presented, that the advanced electrician will find it of use in his work. The great advance of the science makes it a little saddening sometimes to look at books of this character, for if this is what the non-electrical student is supposed to know perfectly, how much will be expected of the electrical student. In a general way, we cannot do more than commend the book, which with its rather restricted use of mathematics and its numerous illustrations and practical hints, is very much to the point, as regards carrying out the matter suggested by its title.

## A TEXT BOOK OF MINERALOGY. By Edward Salisbury Dana. Fully illustrated. Hard covers, size 6"x9¼". Published by John Wiley & Sons, Inc., New York City.

The honored name of Dana appears in the title page of this book of mineralogy. Of this classic of science, Dana's Mineralogy, as we always called it, no less than twenty-seven thousand copies have been issued. The first edition appeared in 1877. The great merit of the book which immediately became the leader of all standards, is shown in the fact that it held the field for twenty years, and it was only in 1898 that the second revised edition was published. Now after nearly twenty-five years the third edition appears. It is pleasant to read that the general character and form of the book have been retained unchanged. Professor Dana has written the preface, and it is very interesting to realize that when a young man of some twenty-eight years, he acquired a world-wide fame by his Mineralogy, which held the field for nearly a generation before the second edition was required. Any attempt to review it is futile, it is so large and so elaborate, and what we have said must be considered a tribute to the personality of the most distinguished author, but is not a review of this exhaustive book. It has a very good general index, followed by an index of species, and it is liberally illustrated with crystallographic and other diagrams, as well as illustrations of apparatus, and to those practicing the science, it is simply a *sine qua non*.

## PRINCIPLES OF ELECTRICAL ENGINEERING. By William H. Timbie and Vannevar Bush. Illustrated. Hard covers, size 5¼"x7¾". Published by John Wiley & Sons, Inc., New York City.

The Massachusetts Institute of Technology in a way may be taken as responsible for this work, written by two of its Faculty, Associate Professors of Electrical Engineering. It is quite an admirable book for study, as each chapter, of which there are thirteen, is followed by a series of problems to be solved, the total number of which is some five hundred. Some very excellent tables of electrical data are given in the last few pages, and the book is indexed. It is designed for college students, and it is said to presume a knowledge of calculus and physics on the part of the student, but this need not frighten anyone, as the use of mathematics in it is far from exhausting, and the subjects in general are most intelligibly presented.

## THE ROMANCE OF COAL. By Charles R. Gibson. Illustrated. Hard covers, size 5"x8". Published by J. B. Lippincott Co., Philadelphia, Pa.

The interest attached to the present work is not at all lessened by the fact that it is an English production with numerous illustrations and much history. It includes all the practical points of mining, explosions in the mines, the condition of the workers and animals therein, all of which makes the book excellent reading. It treats of the Davy safety lamp, of gas and dust explosions. He tells of the condition of the workers, citing an eighty-year-old woman who worked in a mine in perfect contentment. He brings out the fact that the miners do not regard their life as a disagreeable one, and says that pitying the miners whose incomes in some cases surpasses those of highly educated men, is decidedly far fetched.

## THE BOOK OF WIRELESS TELEGRAPH AND TELEPHONE. By A. Frederick Collins. Cloth covers, size 5"x 7"x1½". 217 pages. Fully illustrated.

A good book for the beginner. It is written in a comprehensive manner covering the fundamental principles of wireless telegraph and telephone and contains necessary information for constructing, operating and maintaining both receiving and transmitting stations. Some of the more advanced types of receivers and transmitters are clearly explained. In the back is included a list of the definitions of words and terms commonly used throughout the book. Mr. Collins has succeeded in putting forth the facts of radio in an interesting and practical fashion.

(*Continued on page 692*)

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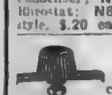

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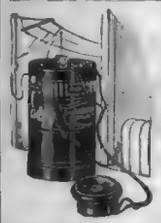

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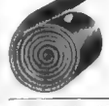
N851 Tin foil .....lb .35

### SWITCH KNOB




N199 Knob is a favorite. 1⅛" dia.; height ⅝"; 8-32 screw. N4151 has 8-32 or 10-32 bushing, no screw.

N199 Knob .....$.10
N4451 Knob .....06

### BRASS STRIP AND TUBING

Brass strip ½" wide; 1-16" thick; 6" long.

N1430 Per length .....$.10
N1431 Brass tubing, ¼" dia.; inside dia. 3-16"; 6" long; per length..... .15

### COPPER RIBBON

Used for connecting purposes .005" thick.

N700 ⅜" wide; N701 ¼" wide; N702 3-16" wide.

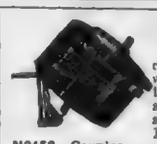
All sizes per foot...$.01

### SILICON STEEL

Used practically in all audio-frequency transformers. Better than iron. Extremely soft. 2¾" wide and .007" thick.

N4900 Silicon steel per foot .....$.08

### BAKELITE 180° COUPLER



Tubes are natural color bakelite, wound with green silk. Aluminum bracket, Fahnestock connectors; ¼" shaft. Primary 13 taps. 180 to 550 meters.

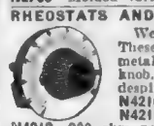
N3150 Coupler .....$2.45

### MOLDED VARIOCOUPLER

Best molded variocoupler parts made in this country. Rotor is 3½" dia.; width 1¾". Primary tube 4¼" dia., 2½" wide. Complete with all brass fittings but without wire. This coupler usually sells from $4 to $6.

N2700 Molded variocoupler .....$1.85

### RHEOSTATS AND POTENTIOMETERS



Well made in all respects. These rheostats come with metal dial and composition knob. Good merchandise despite low price.

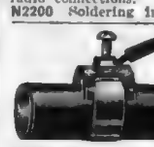
N4210 6 ohm rheostat $.27
N4211 30 ohm rheostat .30
N4212 200 ohm potentiometer .....$.45

### SOLDERING IRON

The smallest and handiest soldering iron made. Fits any flat iron, toaster or percolator plug. Plug then becomes handle. Size 5" long. Complete but without plug or wire. Extremely useful for soldering radio connections.

N2200 Soldering iron .....$1.45

### GROUND CLAMP



Best ground clamp on the market. Fits all pipes from ½" to 2". No soldering necessary. Non-rusting metal strip. Will give most positive connection.

N2238 Ground clamp .....$.15

### SKINDERVIKEN BUTTON Famous Microphone For Transmitters

Sold all over for $1. This is the genuine article. No imitation. Smallest and most sensitive microphone made.

N9595 Microphone .....$.75

### COPPER FOIL

Thinnest copper foil made; .001" thick, 4" wide.

N5025 Copper foil; per foot .....$.10
N5025 Copper foil; per 10 ft. length $.80

### NICKLE PLATED BRASS SCREWS

At last! Fully nickle plated screws for the experimenter. We have the following sizes. 4-36; 6-32; 8-32; 10-32 flat and round head styles; ¼"; ⅜"; ½"; ¾" and 1" lengths.

Price all size threads ¼"; ⅜"; ½". Per dozen .....$.15
¾" and 1". Per dozen .....20

### MAGNET WIRE

The following come on 8-ounce spools:

N2500, Double Cotton No. 18.....$ .50
N2501, Double Cotton No. 20..... .60
N2502, Double Cotton No. 22..... .75
N2503, Double Cotton No. 24..... .85
N2504, Double Cotton No. 26..... .95
N2505, Double Cotton No. 28..... 1.15
N2506, Double Cotton No. 30..... 1.65

The following come on 4-ounce spools:

N2507, Green Silk No. 20.....$ .50
N2508, Green Silk No. 22..... .55
N2509, Green Silk No. 24..... .60
N2510, Green Silk No. 26..... .65
N2511, Green Silk No. 30..... 1.05
N2512, Green Silk No. 32..... 1.30
N2513, Green Silk No. 36..... 1.85

The following come on 8-ounce spools:

N2514, Enameled No. 20.....$ .45
N2515, Enameled No. 22..... .55
N2516, Enameled No. 24..... .60
N2517, Enameled No. 26..... .65
N2518, Enameled No. 30..... .70
N2519, Enameled No. 32..... .80
N2520, Enameled No. 36..... 1.00
N2521, Enameled No. 38, 4 oz. .... .85
N2522, Enameled No. 40, 4 oz. .... 1.15

### MELOTONE LOUD SPEAKER

The best popular loud speaker on the market. Has tuned feature the same as all "Rico" phones. Fibre horn, heavy metal base, five foot cord. Nickle gooseneck. Greatest tuned loud talker. Compares favorably with most expensive speakers. Size overall 11½"; horn length 11½"; bell 6⅝"; total height 9".

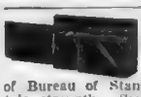
N255 Melotone Speaker .....$4.90

### REINARTZ COIL

Hard rubber center; double silk wire; 15 taps and 3 leads; with screw for panel or board mounting. 4½" diameter; ¼" thick. Duo-spider web wound.

N2560 Coil; 220—600 meters .....$1.90
N2561 Coil; 150—300 meters .....$1.90

### DILECTRYTE PANELS



Latest and best panels. Better than phenolic materials as per report of Bureau of Standards. Highest dielectric strength. Smallest water absorption.

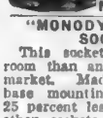
N7100 Panel 7x10x3-16" .....$ .90
N7120 Panel 7x12x3-16" ..... 1.05
N7140 Panel 7x14x3-16" ..... 1.20
N7180 Panel 7x18x3-16" ..... 1.60
N7210 Panel 7x21x3-16" ..... 1.85
N7240 Panel 7x24x3-16" ..... 2.10

### ALCOHOL BLOW TORCH

Best small torch made. Gives intense hot flame. Needle flame can be directed on any spot. Great for finest work.

N8981 Torch 5x1" ....$.85
N8982 Torch 3x⅞" ..... .43

### BAKELITE SOCKET



Octagon shape. Four nickle binding posts, phosphor bronze contact springs. Best bakelite.

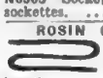
N6510 Bakelite socket .$.40

### "MONODYNE" TYPE SOCKET

This socket takes up less room than any socket on the market. Made for panel or base mounting. It occupies 25 percent less room than all other sockets. Nickle plated and polished tube, fibre plate and 4 sockettes. Guaranteed noiseless tubes. Wonderfull action.

N6503 Socket with four sockettes. .....$.45

### ROSIN CORE WIRE SOLDER



A non corrosive solder with flux inside.

N4104 Solder per 18" length .....$.10

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CONTAINS 75 VACUUM TUBE HOOK-UPS, 350 ILLUSTRATIONS, 550 ARTICLES, 84 PAGES

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## Book Review

(*Continued from page 690*)

CHEMISTRY OF TODAY. By P. G. Bull, M.A. More than 150 illustrations and diagrams. Hard covers, size 5"x8". Published by J. B. Lippincott, Philadelphia, Pa.

Again we are face to face with an English work, which is a very popular presentation of the study of chemistry, a subject which day by day is becoming more recondite, so that it is fair to say, that those interested in it at all, should lose no time in taking it up. Such books as the present, make it an interesting subject, and we cannot compliment the author more highly than by saying that his work really reminds us of Slosson's writings. There are over one hundred and fifty illustrations and diagrams, and many of these are by no means the old friends of early days, but are suggestive and new presentations of the subject. We note particularly the plate facing page 80, illustrating the relations of helium and hydrogen as the fillers of balloons. The chapter on the "Romance of Radium" with suggestive illustrations, including one of a radium engine, if the keeping of a strip of gold leaf in motion can be treated as the movements of an engine. The use of chemically produced colors in photography, the spectroscope in application to the sun, and to other heavenly bodies, and the story of carbon compounds, the relations of chemistry to plant and animal life, are but a few of many subjects most interestingly treated.

RADIO RECEPTION. By Harry J. Marx and Adrian Van Muffling, C.E. Illustrated. Hard covers, size 5"x7½". Published by G. P. Putnam's Sons, New York City.

With its clear type and its simple diagrams this text-book appears on the face to be preëminently simple and elementary. It is a definite fact that much can be done in wireless communication, reception and transmission alike, by very simple apparatus, much of which has been presented in the columns of this magazine, but while this book in its first 173 pages, which terminate with the eleventh chapter devoted to a series of "don'ts", appears to be of the simple order on its face, it really makes an exceedingly compact and easy presentation of the subject. In the appendix is given a touch of the real science and formulae of radio work, the calculation of tuning apparatus, and following some twelve tables a quantity of hook-ups, each one illustrated by very clear diagrams, is given. There is an index to the hook-up diagrams and this is followed by a general index of the book, which we are very glad to recommend to our readers.

HOW TO MAKE THINGS ELECTRICAL. Profusely illustrated. Hard covers, size 4"x7". Published by the U. P. C. Book Co., Inc., New York City.

This book, little in appearance at least, printed on thin paper, contains over four hundred pages, liberally illustrated, and devoted to electric experimenting of the simplest order. There seems to be no end of what can be done by the ingenious electrician in the way of simple experiments, and this book presents in a very agreeable way a great many of such things. It is really a collection of articles published originally in the *Popular Science Monthly*, and the preface states that the book is for those who desire to build their own electrical apparatus—experimenter, student and teacher. No author's name is given. The book is liberally illustrated, and describes in the text any quantity of things to be done for the exploitation and utilization of the electric current. One chapter is devoted to radio work. It is well indexed.

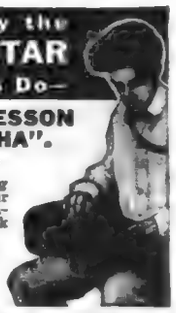
THE GLAND STEALERS. By Bertram Gayton. Hard covers, size 8"5½". Published by J. B. Lippincott Co., Philadelphia, Pa.

The author of this book delves into the gland problem in a very humorous manner. He takes a 95-year old man and implants in him the thyroid glands of a gorilla. Promptly grandpa is rejuvenated, but he does not stop there. He organizes an expedition of nearly one hundred ancients like himself, who are conveyed to Africa, where he establishes an aeroplane base, and with his trusted assistants makes his way into the jungle, where a number of gorillas are captured alive. Science enters into the capture of the gorillas, as they are gassed by means of an unnamed gas, and are promptly put into irons. What happens after the expedition has been equipped with the new glands we would rather leave to the reader to find out.

This is an excellent story, written by an English author of ability, who knows how to keep the reader smiling from beginning to end.

(*Continued on page 694*)


**You, Too, Can Play the HAWAIIAN GUITAR Just as the Natives Do—**



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Our method is so simple, interesting and appealing that you begin in your first lesson to learn the famous Hawaiian Folk Song "ALOHA". Think how happy you will be when you surprise your friends by playing the fascinating Hawaiian Guitar *just as the natives do!*

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Actual Size
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**AS RADIO FREQUENCY AMPLIFIER AND DETECTOR**

$7.50

**OVER**
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Dear Sirs:—When your Monodyne sample arrived, to be entirely frank, we did not believe it capable of doing very much on long distance work. After carefully testing the set, we feel that we owe you an apology.

The National Monodyne naturally percolated all over the place; we heard Davenport, Chicago, Dallas, Texas and Atlanta, Ga. The next night we took it to the home of Mr. McCreary, President of the Western Radio Company here, and we heard another string of stations, using the WD-12 tube with two 22½ "B" batteries.

Your Monodyne is certainly a wonder and we should be very glad to stock and advertise it locally.

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Yours very truly,
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**Can be used to increase or shorten wave lengths**

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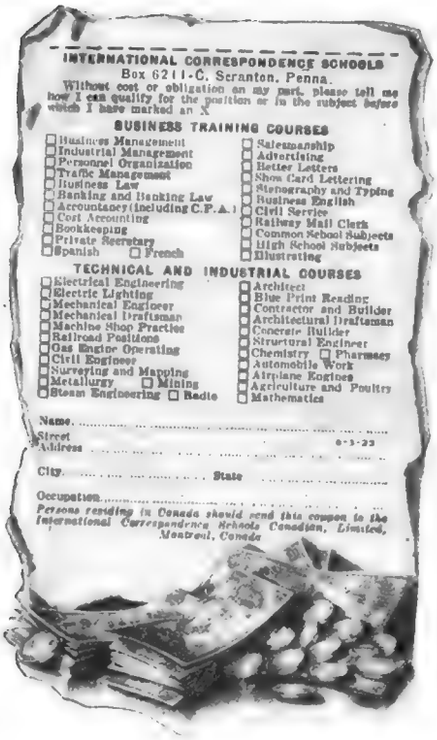


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## Book Review

(*Continued from page 692*)

DIRECTION AND POSITION FINDING BY WIRELESS. By R. Keen, B. Eng., A.M., I.E.E. Cloth covers, size 5½"x8½". 376 pages. Illustrated. Over 250 photographs and diagrams.

This book completely covers every phase of the principles and practice of direction and position finding developed in wireless. From early experiments up to the present improved system, nothing has been left out. This treatise not only deals with the principles of the subject but also with the construction details of direction finding installations for shore service and for the navigation of ships and aircraft; also with such subjects as the use of special maps for D. F. work, the freak phenomena which cause errors in bearing peculiar to the D. F. receiver. The last chapter on field and nautical astronomy is very useful in connection with the practical application of direction finding.

THE BOOK OF THE SKY. By M. Luckiesh. Illustrated, hard covers, size 5¾" by 8½", 236 pages. Published by E. P. Dutton & Co., New York City.

The General Electric Company has attracted to its service some of the most eminent scientists of America, among them Dr. Luckiesch, who is the Director of Applied Science at the Nela Research Laboratories. The book is not devoted, as its title might seem to indicate, to astronomy, but to meteorological phenomena and to aviation. Most picturesque descriptions of the practical work of aviation and the performance of feats, take many pages and give most interesting reading. The book is so good, so handsomely printed, and so beautifully illustrated, that it is with regret that we state it has no index.

ASTRONOMY FOR YOUNG FOLKS. By Isabel M. Lewis. Fully illustrated, hard covers, size 5¼" x 8½", 267 pages. Published by Duffield and Co., New York City.

It was with no small feelings of interest and friendship that we opened this book. Mrs. Lewis is a true friend of our readers. Her most interesting papers have been one of the great attractions of SCIENCE AND INVENTION. She has the art of presenting what seem to be the abstruse parts of astronomy in so popular a way, as to make it all thoroughly good reading. Much of the text of this book is made up from articles which have appeared in *"St. Nicholas"* and in SCIENCE AND INVENTION, and revision has been used where necessary to simplify the treatment, so as to bring the topics within the comprehension of a child. It is not too much to say when this is done with so difficult a subject as astronomy, that its degree of success measures the ability of the author. It is curious to read in the light of a paper at a recent meeting of the Association for the Advancement of Science, the uncertainty that exists surrounding the temperature of meteorites. So many of our readers have followed with deep interest Mrs. Lewis' papers as they have appeared in our columns that the book will be of special interest to them. We regard it as a great pity that it has no index, for it certainly contains a mass of information.

THE BOOK OF RADIO. By Charles William Taussig. Profusely illustrated, hard covers, size 5½" x 8¾", 447 pages. Published by D. Appleton and Co., New York City.

The descriptive title page in this book states that it is a complete simple explanation of radio reception and transmission, and an interesting comment on the development of radio would seem to be deducible from the fact that its alleged simple explanation fills upwards of four hundred octavo pages. When we examine the book, the impression made is certainly one of clearness and simplicity, and its numerous illustrations and diagrams, nearly two hundred in number, tell its story in very good shape. The section devoted to radio amateurs, in which very many instances are given of true service to the Government by amateurs is interesting. So it would seem that the American system, not so much of favoring amateurs, as of letting them alone, has had an excellent effect. The War brought out the fact that the army of amateur radio operators was a thoroughly loyal one and they are to be credited with good war work. The book is adequately indexed.

(*Continued on page 696*)

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The "Autoplex Receiver" is the long expected one-tube set that will work a loud speaker. This circuit was invented by M. L. Muhleman of the Radio News Staff and is bound to become popular because it will operate wherever placed and requires but a ground connection. Every station within its range is amplified sufficiently for a loud speaker. Tuning is very simple, there being but two controls. It is inexpensive as to parts and easy to construct. Any tubes from the "peanuts" up to the "big ones" can be used. This receiver knows no such thing as "critical filament adjustment." It will receive the high powered trans-Atlantic stations without any changes in the circuit; a twist of the dials and the broadcast stations come in.

The complete plans for the construction of this set are contained in a three-colored, heavy manila packet, 9x12 inches and consist of full sized blue print for wiring and drilling and also a four-page instruction pamphlet giving complete details even as to tuning. Price complete..... **50c.**

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### How to Make a Reinartz Receiver

The original Reinartz Receiver is the most popular type of set in existence today. It gained its popularity through its simplicity of operation and capability of long-distance reception. Full directions for building this receiver are given in this folder. The construction of the coil—the most difficult part—is made easy with the concise instructions we furnish. The connections of the set are shown plainly, so that the novice will have no trouble in following them.

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### How to Make a Cockaday Receiver

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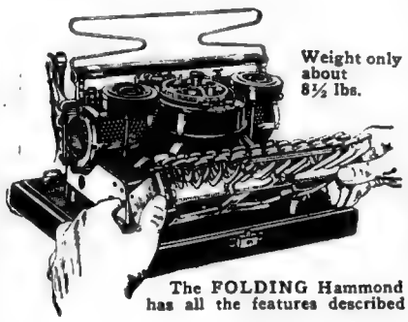


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## Book Review

(*Continued from page* 694)

ICE AGES. By Joseph McCabe. Hard covers, size 5" x 7½", 134 pages. Published by G. P. Putnam's Sons, New York City.

This little work is quite interesting. It is written entirely from a popular standpoint, the author attempting to cover the subject in one hundred and thirty-four pages. It is quite an interesting presentation of a subject, which might be a very dry one; the comparatively few illustrations are quite to the point. The author upholds the work of Darwin, bringing out the point that his original views on animated nature are only too often misunderstood.

THE NEW AIR WORLD. By Willis Luther Moore, Sc.D., LL.D. Illustrated, hard covers, size 5½" x 8¼", 326 pages. Published by Little, Brown and Co., Boston, Mass.

This is preeminently a practical little book, enough science being mingled with it to give it a pleasant aspect. The taking of weather observations, how the atmosphere is explored by small balloons, which are liberated with automatic registering instruments, light, heat and temperature, and humidity, and the general branches of meteorology, are given. A considerable space is given to the forecasting of the weather, and in this same section some illustrations of the work of tornadoes, such as the driving of common straws, fragile as they are, one-half inch into wood. A shovel driven into a solid tree to a depth of six inches, is an example of what the wind can do. One chapter is devoted to how climate is controlled. This does not mean that man can control it of course, but it tells how the features of the earth's surface do it. The question of the change in climate comes in, something which people are never tired of discussing, and an interesting chapter is devoted to climates for health and pleasure. An exceptionally good index closes this very interesting book.

ORGANIC CHEMISTRY. By W. H. Perkin, Ph.D., and F. Stanley Kipping, Ph.D. Illustrated, hard covers, size 4¾" x 7¼". Published by J. B. Lippincott Company, Philadelphia, Pa. Two volumes, total pages 666.

If our readers are interested in Tetramethyl-p-diaminotriphenyl-methane and other such luminous products of the chemist's art, he will find himself well taken care of in this little work. It is in two volumes, with six hundred and sixty-six pages of text. It is simply impossible to review it in the space allotted to us for individual books, but we can only say that it seems to be very well arranged and certainly is very full. The equations are given with the old-fashioned equality sign instead of arrows, a feature, which to the older chemist is not unwelcome, for some of the recent improvements are more or less disconcerting to the graduates of the last century. Although this is all we can say of the book in this hasty review, we certainly do strongly recommend it. The two volumes in which it appears, make it exceedingly convenient for a reference, and in it we get the usual view of the science. Speaking of carbohydrates, the author remarks on the change of nomenclature, which has been brought about by the inclusion in the group of nearly related compounds, in which the hydrogen and oxygen no longer exist in the proportions as in water.

LABORATORY GLASS BLOWING. By Bernard D. Bolas. Fully illustrated, hard covers, size 5" x 7¾", 106 pages. Published by E. P. Dutton & Co., New York City.

There is something fascinating in watching a glass blower at work, one always desires to do the same, and it is for people having that ambition, that this book is written. It is designed absolutely for the chemist, and amateur, yet it is fair to say that anyone who masters its contents to the degree of being able to make what is shown in it, will be a skillful operator. It takes skill to make even simple potash bulbs. No two people work glass in exactly the same way, so we find certain discrepancies from our own point of view. The art of working glass consists in instinctively "feeling" it, so as to know just how to support it, so that it will not drag out too thin. A rather interesting part tells of using a mouth blow pipe for glass work, which certainly seems to be quite a feat. As small as the book is, it is indexed, so that it is an example to publishers and authors in that regard.

ELEMENTARY DETERMINANTS FOR ELECTRICAL ENGINEERS. By H. P. Few. Illustrated, hard covers, size 4¾" x 7½", 95 pages. Published by D. Van Nostrand Co., New York City.

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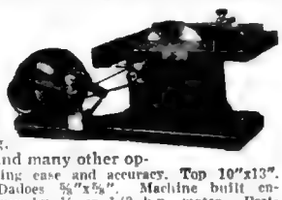

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their evaluation as applied to the solving of simultaneous equasions, is exceedingly interesting, and here we have them applied to electrical problems. They are supposed to be a short road to answers and we find them applied to such problems as the finding of the resistance of a net, and applied to Maxwell's classic rule for net works, which in its simplicity, and power of solving most difficult problems of net-works, is an exceptionally interesting method of real numerical solutions. We are glad to say that the ninety-five pages of this little book, which may be said to be unusually full for its size, are indexed.

HOW TO MAKE LOW-PRESSURE TRANSFORMERS. By Prof. F. E. Austin. Fully illustrated, hard covers, size 4½" x 7¼", 22 pages. Published by Professor Austin, Hanover, N. H.

This book is printed in green ink, and for that reason presents a rather peculiar appearance. It is very short but quite to the point, with numerous illustrations, considering its very limited size, and certainly quite businesslike in its aspect. The colored ink presumably is used to spare the reader's eyes, although it is an open question whether it does so. We are sure our readers will appreciate it.

GRAVITATION VERSUS RELATIVITY. By Charles Lane Poor. Illustrated, hard covers 5½" x 8¼", 277 pages. Published by G. P. Putnam's Sons, New York City.

Professor Poor, the very distinguished Professor of Celestial Mechanics in Columbia University, has in this book presented a most interesting treatise on astronomy. In thus defining it, the reviewer feels he is not going a step too far, for it includes any quantity of detail as to the practical work of astronomers, the limits of accuracy of their determinations, and so much general information on the subject of observatory work, that it is a most interesting book even from that standpoint alone. When we hear so much of the Michelson-Morley experiments, it is very interesting to find presented here photos of the interferometers as used to test ether drift. The frontispiece shows the site on Mount Wilson where the interferometer house is situated and here at an elevation of 6,000 feet indications of ether drift were actually obtained, which goes to invalidate the Einstein theory. The book is written specifically to combat Einstein and Professor Poor gives a wonderfully good description of the experimental and observational basis of the Einstein theory. The illustrations are quite to the point. For those of us who cannot quite swallow everything in the Einstein theory, who find it hard to believe that according to the Lorentz-Fitzgerald contraction theory, a Pullman car is shorter when in motion than when standing still, it is refreshing to find it contested by so high an authority. The diagrams in the book are especially illuminating, and a very interesting reproduction of the photograph of the 1921 interferometer is especially to be noted. The book will repay not only one but several careful perusals. It has an excellent index and is very well made up. Professor Poor makes a very usual mistake in taking the Pythagorean proposition of the square of the hypotheneuse as being the Pons Asinorum. The Century Dictionary notes this as a mistake frequently made.

THE GLANDS REGULATING PERSONALITY. By Louis Berman, M.D. Hard covers, size 8⅝"x5⅞", 300 pages. Published by The Macmillan Company, New York City.

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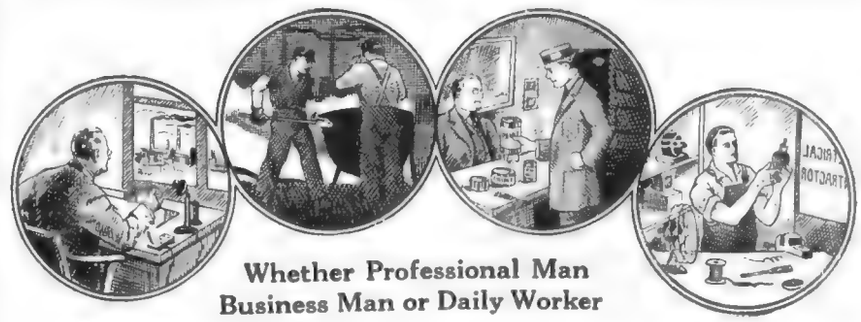

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:hrone. Upon the throne is what? Man, the most baffling of complexities. Man who is not a mind, but owns a mind—Man who is not a body, but possesses a body, just as he might have a motor car, a fortune or a calamity. Back of all his daily activities, behind the life of body-mind is the mysterious unique individuality, the Ego, the Psyche or the Soul. Lately a competitor with these ancient and honorable terms has come upon the scene as the Subconscious. In that darkened No Man's Land is determined a man's destiny. The endocrine association stands out as at least the most important physical detriment of the states and processes of the subconscious."

PRACTICAL RADIO. By Henry Smith Williams. Stiff covers, size 5" x 7½". Published by Funk & Wagnalls Company, New York, N. Y.

**The book is an excellent treatise on radio from the amateur's standpoint, and beginning with the very simplest installation of receiving apparatus; antennae and grounds, the author leads the reader up to the more complicated sets, employing many stages of amplification. The action of the various instruments in a radio receiving outfit is very clearly shown, and the functioning of both crystal and audion detectors is made very plain by means of diagrams.**

**Aside from showing how to hook up, various types of radio sets, the author enters into the construction of several of them, giving the electrical characteristics and all other necessary data.**

**The book is up-to-date in every way and fully illustrated. A complete table of contents and** cross index aid materially in locating any particu**lar item desired.**

IM KAMPF UM DEN GIPFEL DER ERDE. By Walther Flaig. Hard covers, size 7¾" x 5¼", 76 pages. Profusely illustrated. Published by Kosmos, Stuttgart, Germany.

We have often had occasion to comment on the very attractive little series of books published by the German scientific journal "Kosmos." In the present one it treats of the Himalaya Mountains, and puts the question as to whether Mt. Everest or Tschmo-Mungma is the higher, or is to be called the apex of the earth. It describes the attempt to reach the summit, and with numerous very picturesque little cuts, makes most interesting reading. Many animals are shown and a number of the illustrations are devoted to features on the life of the country, and the costumes of the inhabitants, while the representations of the approach to the summit are quite impressive. The book is certainly to be warmly commended to our readers. The portraits of the explorers, General Bruce, Dr. Mallory and Lieutenant Finch, show very determined looking faces. The book gives credit to General Bruce as being the leading authority on the practical attack on the Himalayas. The highest credit is given to the English climbers, and a picturesque description of their hardships on the mountains included.

X-RAYS. By G. W. C. Kaye, O.B.E. Hard covers, size 5½" x 8¾", 319 pages. Fully illustrated. Published by Longmans, Green & Co., New York City.

This very excellent work is specially to be commended for its very first page and its last pages. The first page gives in tabular form the data, nature, and properties of the various kinds of rays, based on electrical considerations and taking them as carriers of positive or negative electricity in some cases, such as cathode and Leonard rays, and in other cases as electrically neutral, such as Hertzian rays, visible light rays and X-rays; the one table contains an astonishing array of data. The last pages which we commend so highly, are an eighteen-page index. We have no room here to review the book at all adequately. It takes up the X-ray largely from the practical standpoint, its production and uses, different kinds of X-ray tubes, precautions to be used by the operator, radiography in detail with many wonderful examples of radiographs. The book is so concise, and so well arranged, that nothing short of a perusal will do it the slightest adequate justice, and we unhesitatingly recommend it to our readers. The tables are of great interest and are admirably selected as are the other appendices, in which various other subjects are covered, besides the data contained in the table.

METALS AND THEIR ALLOYS. By Charles Vickers. Hard covers, size 6" by 9¼", 767 pages. Many illustrations. Published by Henry Carey Baird & Co., Inc., New York City.

The old name of Henry Carey Baird holds an honored position among scientific book publishers. For many years he was identified with Philadelphia, but now the publishing house has moved to New York and is devoted as always to the rather serious line of technical books. The writer well


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remembers how Mr. Baird himself once told him that he and one of his assistants were the best of all index makers, and the index to this book certainly looks like one of the old Baird indexes, and really would seem to do justice to the exhaustive text. Now turning back we find in the text a great number of alloys treated, entirely up to date. Such subjects as electric furnaces, which are the great development in modern metallurgy, may supply an example of what is spoken of. Numerous illustrations are given. The division of the book takes up one metal after another, one alloy after another, and gives all their properties, the manner of making the different alloys and their qualities. It is more than a book brought up to date, although it is based on the third edition of Brandt's well-known book "Metallic Alloys." We note that such things as aluminum alloys for cooking vessels, for crank cases, for Zeppelin and airplane construction, for piston alloys are included under the one heading of "Aluminum," and in the same chapter, numerous other aluminum alloys are given. Monel metal is treated, white brass is given under the section entitled, "Manganese Bronze and White Brass," and there is an entire chapter on amalgam and other mercury alloys, and another on die casting. It will be seen how extensive is the scope of the book. The analysis of Babbitt metals has an entire chapter devoted to it, and the last chapter gives foundry data, even to such details as first aid in the foundry and treatment of bruises, sprains, burns and gassing.

INDUCTION COILS IN THEORY AND PRACTICE. By Prof. F. E. Austin, E.E. Hard covers, size 5½" x 8½", 64 pages. Illustrated profusely. Published by Professor F. E. Austin, Hanover, N. H.

This is a very brief treatise on its titular subject, all arranged in numbered paragraphs, and taking the shape of practical details of construction and calculations for construction of coils. In spite of its briefness, it is really quite interesting; a section devoted to interrupters, although but a few pages, is very good reading. The mathematical theory is treated of to a certain extent; constructional features, data of copper magnet wire, and various examples of the construction of coils for different purposes, is given.

DAS SCHOOPSCHE METALLSPRITZ-VERFAHREN SEINE ENTWICK-LUNG UND ANWENDUNG.—By Hanns Gunther and M. U. Schoop. Fully illustrated, 263 pages, size 5¾" by 8¾". Published by Franck'sche Verlagshandlung, Stuttgart, Germany.

Although this book does not seem very large, yet when it is found to contain two hundred and sixty-three pages of close printing, it will be realized that it is actually a full treatise on its title subject, and the title subject is the deposition of metals by spraying. It is a version of the air brush in which melted metal is substituted for the pigment. Very remarkable results are achieved by this process, and many illustrations throughout the book elucidate the matter very thoroughly. We are not prepared to give it an adequate review as the space at our disposal is insufficient, but it is enough to say that it has technical illustrations of the apparatus, as well as of examples of the products, and of the accessories used in carrying out the process. Just as in the case of the air brush, there is involved a certain contamination of the air of the workshop, and this point is not overlooked in the book, one of the illustrations showing a cabinet for carrying off the fumes. The metal spray is produced by melting wire at the apex of the blow pipe, and in a very clear illustration on page 117 two such wires fed at right angles into the flame are shown. Many other illustrations give different ways of effecting the result, some showing the use of the electric arc for producing the melted metal, which, dropping down into the tip of the blast, is atomized and deposited as desired. The familiar liquid-gas tanks appear in some of the illustrations, bringing the air brush vividly before us, and the pistols, as the Germans term the blowpipes, are also well illustrated.

THE QUANTUM THEORY.—By Fritz Reiche. Translated by H. S. Hatfield, B.S., and Henry L. Brose, M.A. Illustrated, 183 pages, size 5" x 7½". Published by E. P. Dutton & Co., New York City.

We should certainly be very slow to attempt to review a work on so abstract a subject. The book in brief is devoted to the exposition of the Quantum theory and allied theories. It is hardly too much to say that the work consists of a mass of mathematics with elaborate explanations accompanying the formulas. The introduction says that the Quantum theory is yet comparatively young, and first saw light in 1900, and the writer depicts the Quantum theory as being absolutely revolutionary. The translation reads very smoothly and it is not too much to say that it is so well done that one would hardly suspect it of being a translation from the very definite German language.

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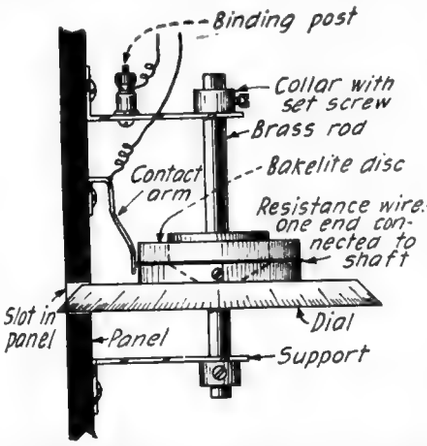
## Radio Wrinkles

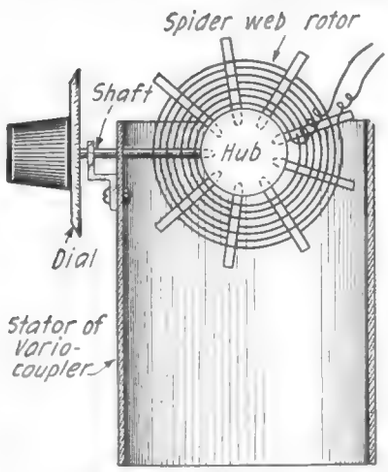
Edited by A. P. PECK, A. M. I. R. E.

### CONTINUATION OF RADIO DEPARTMENT

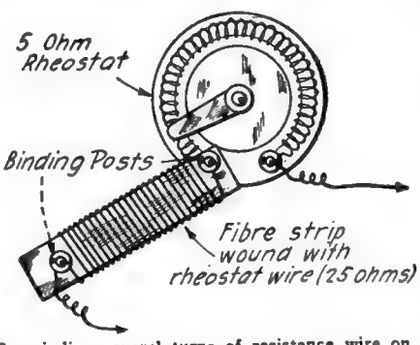
Under this heading we are going to publish items of interest to everyone who likes to build radio instruments. In order to continue this department it is necessary for our readers to tell us about their latest experiments. So write us a short description of some time- or money-saving kink you have discovered and send it to us along with a few sketches. Our regular prizes will be paid for this material. Be brief and try to put everything in the drawing. Don't be too elaborate. Address "RADIO WRINKLES" editor, care of Science and Invention.




A vernier rheostat with professional appearance may be made from a bakelite knob and dial as shown above. The rheostat is actuated from the front of the panel by turning the edge of the dial. Use in series with a standard rheostat.
—Merrill Bolyard.




A simple method of winding and mounting a spider-web coil rotor in a variocoupler is illustrated above. Both bearings are located on one side of the stator. For standard work, 40 to 60 turns of wire should be wound on the rotor.
—Verl A. La Vanway.




By winding several turns of resistance wire on a fibre strip, a handy addition to a standard five-ohm rheostat may be made. It can be made an integral part of the instrument by fastening one end to the binding post as illustrated above and making the connections as shown. This is useful with the new low-voltage tubes—Fred Stroberg.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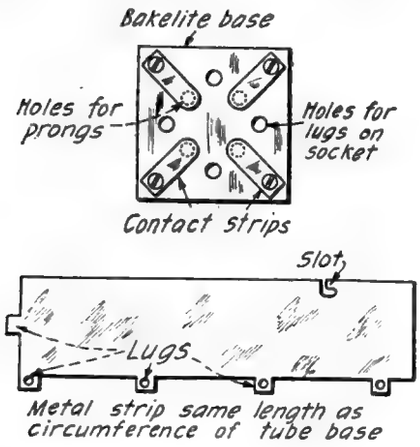
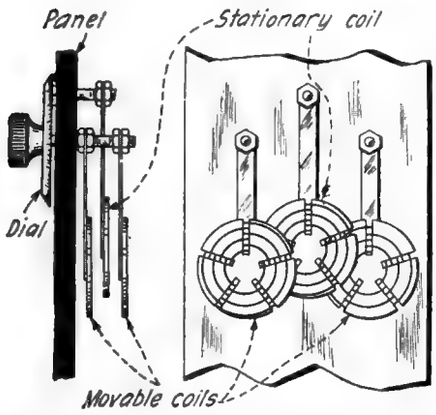
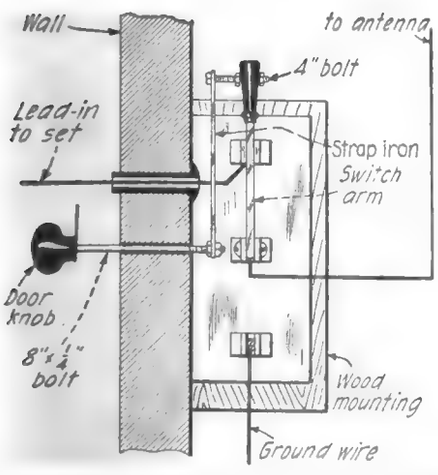


In trying out a new circuit, an extra socket is very often desired and one may not be on hand at the time. When this happens, you can make an efficient socket from a scrap of bakelite and a few strips of brass or even a piece of an old tin can. The constructional details are shown above.
—Loran Black.




Three spider web coils may be readily mounted on the back of a panel and controlled from the front by using the method of mounting illustrated. The coils are fastened to three bakelite strips which are in turn bolted to shafts which extend through the panel and are turned by handles. One coil is stationary while the other two may be moved.
—John D. Davis.




Very often an amateur desires to control his lightning switch from within the house. By installing a switch as shown above this can very readily be accomplished. A fairly stiff length of strap iron must be used in order to make the working of the switch positive.
—Harlow Rouse.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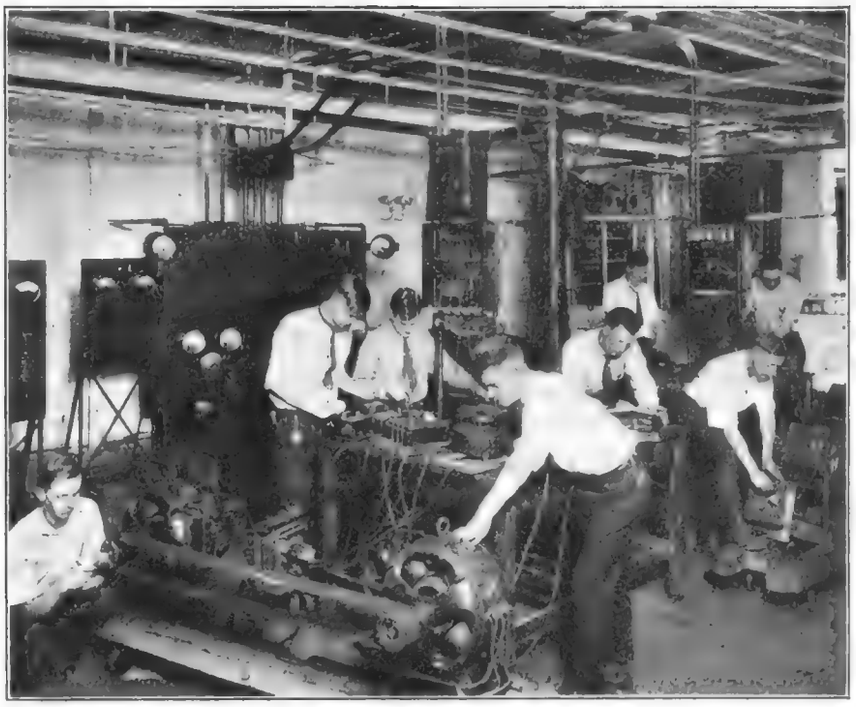

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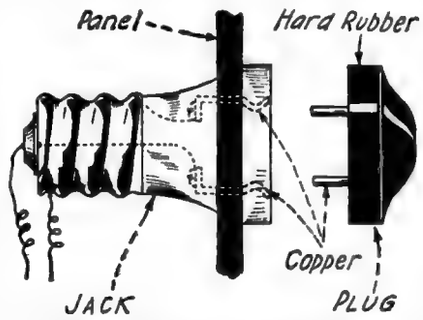
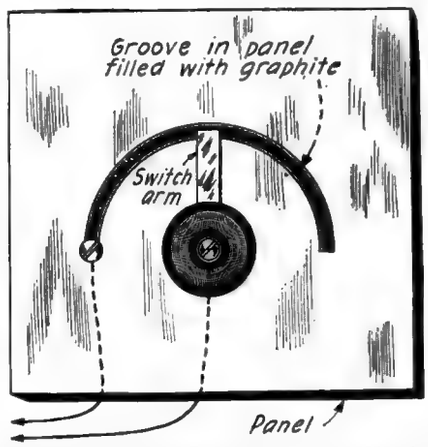
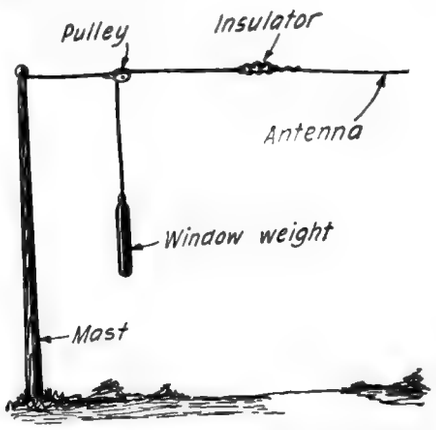


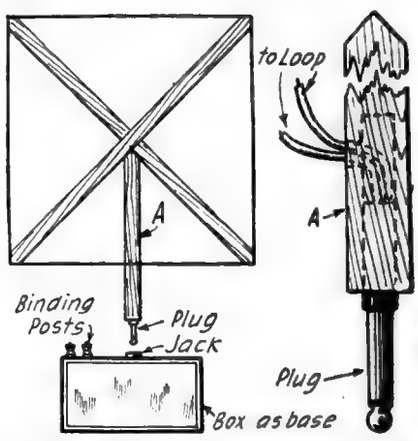

A very efficient plug and jack may be made as illustrated above. A large hole is drilled in the panel, and the base fastened therein by shellac.
—Raymond Anderson.




By scratching a deep groove in a semi-circular form on the surface of a radio panel and filling the groove with graphite from a soft pencil, a grid leak is made. —Clifford Haltalin.




When an antenna is fastened to a slender pole, the swaying of the support often breaks a wire. This can be avoided by a window weight arranged as shown. —Samuel H. Emmes.




A good support for a loop aerial may be made as shown. An open circuit jack is mounted in a box base. The loop can be swung in any direction without tangling connection wires.
—Roumain Peters.

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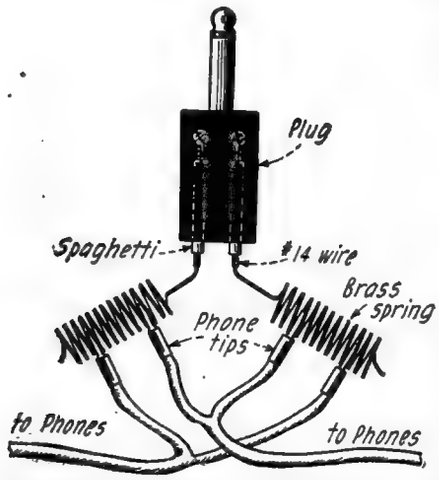
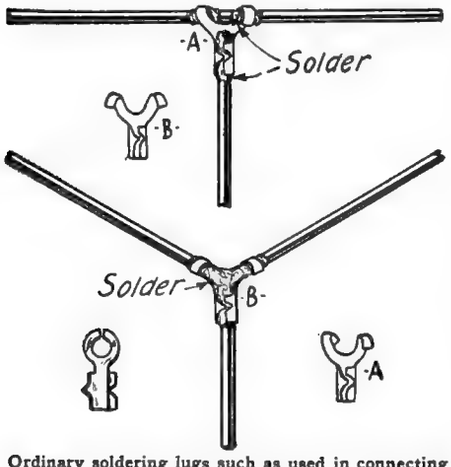
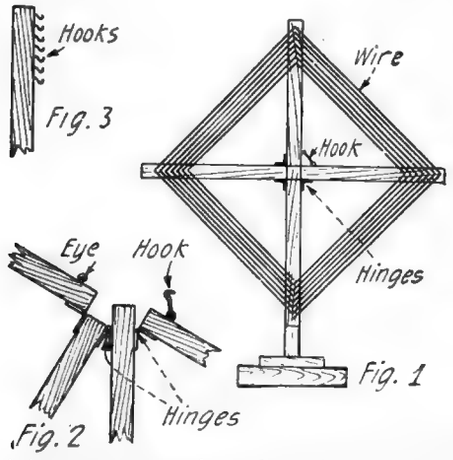


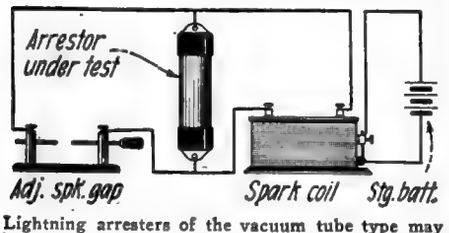

By winding two small coils of spring brass wire and connecting them to a standard telephone receiver plug as shown any number of sets of phones may be connected to a single plug.—John Hetzel.




Ordinary soldering lugs such as used in connecting wire to binding posts in radio sets can be used in other ways. Two methods of using these lugs for soldering wire or bus bar connections are shown above. —A. L. Porch.




A loop antenna may be made so that it can be readily folded for transportation by using three hinges and a hook and eye as shown. The wire should be wound on hooks as indicated so as to be readily removable. —W. A. Waddell.




Lightning arresters of the vacuum tube type may be tested as shown above. If a small stringy spark discharge is observed it is not satisfactory, but if a peculiar characteristic glow is perceptible, the arrester is in good condition. —John M. Avery.

(*Continued on page 708*)

# Multiplying Man-power

To the man with pick and shovel the digging of holes for telephone poles is a slow and arduous task. Under favorable soil conditions three to five holes are for him an average day's work. Under adverse conditions perhaps he can account for only one. When the hole is dug, eight or ten men are required to raise the pole with pikes.

But the hole-borer with derrick attached, operated by only three men, can erect as many as eighty poles in a day—releasing for other telephone work upwards of forty men.

Hundreds of devices to quicken telephone construction, to increase its safety to the employee, and to effect economies are being utilized in the Bell System. Experiments are constantly being made to find the better and shorter way to do a given job. Each tool invented for the industry must be developed to perfection.

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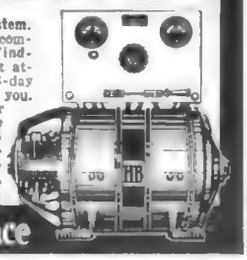

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### COMBINATION TAP AND DRILL

(741) A. R. Mandon, Ouray, Colo., asks for our advice concerning a combination drill and tap.

**The combination drill and tap idea shown above is very old. It has been found inefficient.**

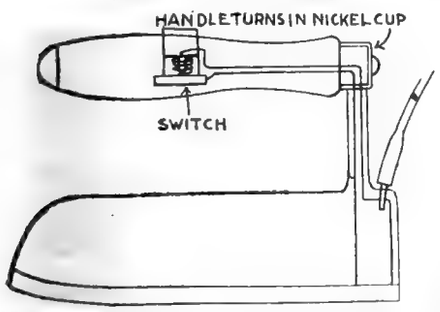
A. There is no need of attempting to obtain a patent on the combination tap and drill, as many of these have been upon the market and have been discarded, because of their comparative inefficiency. The device is not patentable, as we know positively of its previous use.

### GARMENTS

(742) John D. Colvin, Parsons, Penn., requests our advice on under-garments made in such a manner that a body belt causes a blousey effect on the part of the upper section of the garment, the intention being to prevent the ripping of the underwear when they are saturated with perspiration, as the looseness will not cause such great friction on the skin, permitting the garment to slide over the parts of the body in movement.

A. We do not believe that you can possibly obtain a patent on the idea of which you wrote. The suggestion is extremely old, and is of no intrinsic value. We doubt if there are any shirt manufacturers who would undertake the construction of such a shirt. We do not advise patent procedure.

### FLAT IRON SWITCH




**The switch for flat irons shown here could not pass the Fire Underwriters' rules.**

(743) Laurence Burns, Hoosick Falls, N. Y., asks for our advice regarding a switch in the handle of a flat iron to control the current.

A. We do not believe that the switch you have designed for flat irons, will pass the Underwriter's rule and regulations. Hence, we do not advise applying for a patent.

### ROYALTIES AND PATENT SALES

(744) H. R. Borchardt, Phoenix, Ariz., requests our advice concerning maximum and minimum royalties and cash payments on inventions, particularly with reference to two of his own patents—an automobile headlight and an automobile signal.

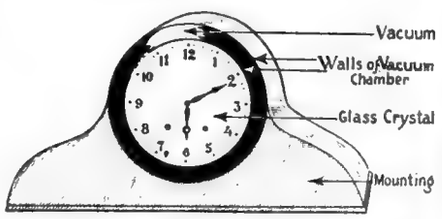
A. There is no question of maximum royalties and maximum cash payments on inventions. Some inventions bring practically nothing. Royalties on some are less than one quarter of 1 per cent, and yet the total amounts run into millions. In other inventions the royalties may be several hundred dollars on each device, the inventor may be fortunate indeed if his bank-roll increases to the amount of $200.00 or $300.00 a year. Ten per cent is a very good royalty, although we know of some individuals who receive as high as 52 per cent.

On smaller devices, such as stoplights for automobiles, spark plugs, fountain pens, household utility devices and such things which sell extensively, the royalties can be considerably smaller, one to five per cent being very fair. The proposition is to try to get as much as you possibly can, and if the concern absolutely refuses to talk at your figure, ask them for their proposition, and tell them that you will think it over, and then try to place it with other individuals. If you can receive no better offer, take the best one given. Cash payment, plus a royalty, is quite the usual method of procedure.

We believe that for the headlight lenses you should receive $5,000 to $10,000 in cash, if of course, they are as good as you claim. On the royalty basis, $1,000 with 20 per cent royalties would be a very fine proposition. Even a 5 per cent royalty here could be considered fair, providing the concern will agree to manufacture a definite number of the headlights, so that your returns will not be less than $5,000 a year. The auto signal should sell for much less, as it is a relatively poor proposition.

### TICKLESS CLOCK

(745) David Bone, Somerset, Pa., requests our advice on a tickless clock enclosed in vacuous sound-proof chamber.




**Manufacturing cost of the tickless clock makes it valueless for commercial purposes.**

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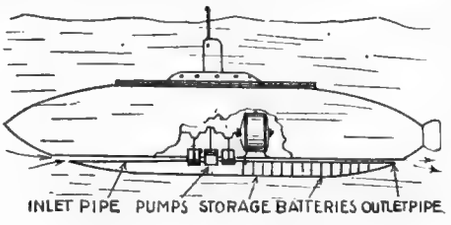
A. The idea is poor. The possibility of making a clock operate, enclosing the same in a vacuous space or sound-proof chamber is not new, the various space would cause the cost of the clock to mount so high that individuals would prefer the more or less quiet tick, to the expense which such a clock would incur.

We certainly would not advise applying for a patent upon this idea, as the possibility of placing the same upon the market is negligible.

### SUBMARINE

(746) George Beyer, Minneapolis, Minn., states that submarines are located by the sound of the propellers as they beat the water. He, therefore, desires to substitute pumps for the propellers, draw the water in at the front end of the submarine, and expel it forcibly from the rear, in this way eliminating the sound.

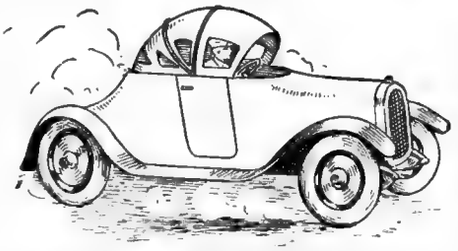



**Erroneous idea as to noise of submarine makes the idea shown above valueless.**

A. Your noiseless propelling device for submarines is of no value since the electric motors which are used to drive the submarine below the surface, create the hum, which is picked up by the sub-sea microphones of destroyers. It is an impossibility to operate a Diesel engine below the surface with any degree of safety, and one cannot eliminate the hum of a motor as it revolves driving the craft ahead or operating pumps. The propellers of the submarine could be disconnected from the motor driving mechanism entirely without disturbing in any way the microphonic sound as long as the motors are in operation.

### MOTOR CAR

(747) Walter Bell, Detroit, Mich., takes exception to our "Motor Car of the Future" and sends in his own design of a futuristic motor car.



**Auto body designer fails to consider stream-line effect in the above model hood and top.**

A. We do not hold that the motor car of the future will look anything like your automobile. You have not taken streamline effects into consideration, but merely protected the occupant with a different style of hood. Speed is the forthcoming thing, and that must be coupled with aviation. The future method of transportation will be via the air.

### GAS VALVE, NEEDLE SHARPENER, ETC.

(748) Hyman Biegeleisen, New York City, requests our opinion on a gas valve to regulate the flow of gas; a phonograph needle sharpener; a microphone reflex relay; and an X-ray tube for converting sound vibrations into light waves.

A. Regarding the gas valve of which you spoke, we would advise that quite a few patents on this same subject have been taken out, some of them dating back as far as 1898, which patents of course, have since expired. There seems to be very little hope for the gas jet I described some time ago in the article to which you refer and even this device was patented, if we recall correctly, about five or six years ago.

With regard to the phonograph needle sharpener, we would suggest that an idea very similar to yours was published about four years ago in this journal. This device was already patented. There were several other phonograph needle sharpeners also published, one of which had a revolving oscillating wheel or grindstone with a soft iron core which is used for polishing the needle. We doubt if the phonographic turn table will develop enough power to sharpen the needle, but even if it did your device would have to be more complicated than you show it. The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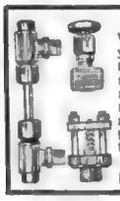

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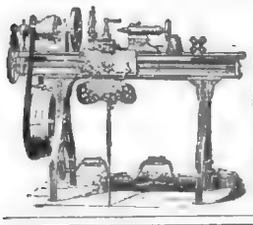

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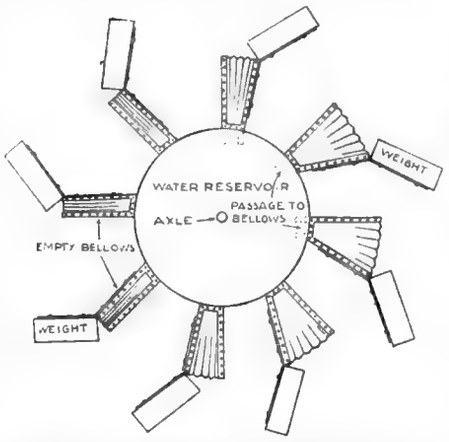
needle would have to be turned as it is sharpened, and a system for polishing would have to be employed. If you are in a position to market this device, however, at a very reasonable figure, about $1.00 or $1.50, it might be a good idea to develop the same.

Your microphone reflex relay will not operate properly, and consequently we would suggest that you forget this idea.

Why use an X-ray tube for converting sound waves into light waves? An X-ray tube is the least efficient of any device yet designed for this purpose? Dr. de Forest has a device which automatically converts sound waves into light fluctuations, and which he calls the "Photion" or "Luxion." There are many other similar devices using a small straight incandescent filament.

### PERPETUAL MOTION

(749) H. N. Bagley, Stockton, Calif., requests our opinion on a perpetual motion machine.




This design of perpetual motion machine has been "invented" regularly for 200 years past.

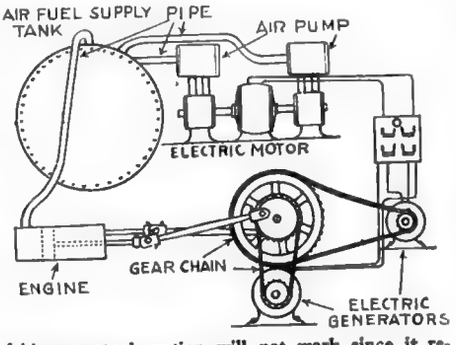
A. The idea is not original. If you will purchase a copy of the book called "Perpetual Motion," by Percy Verance, you will find that your suggestion originated more than two hundred years ago.

### PERPETUAL MOTION AGAIN!

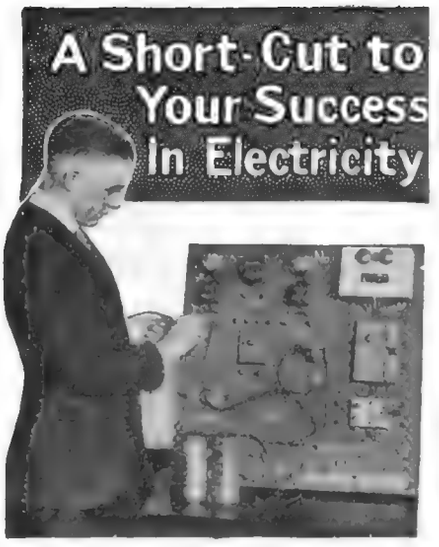
(750) Lois J. Brune, Algiers, La., asks our opinion on a perpetual motion machine, shown in the accompanying diagram.

A. There is less possibility of your perpetual motion machine working, than the one described by Mr. Hooks. It is true that air if under pressure can be made to operate a turbine, the turbine can, in turn, be made to operate a generator. It is also true that the generator can operate a motor, and that the motor can compress the air. The best known air compressor on the market today develops about 54 per cent efficiency, and for each 100 horsepower put into the motor which drives the air compressor, you can but obtain 54 horsepower of work by utilizing the compressed air. This energy is then transmitted to a turbine. This develops 80 per cent efficiency, reducing the total efficiency up to this point to a little more than 40 per cent. The turbine operates a dynamo having a maximum efficiency of 90 per cent, further reducing the efficiency to 36 per cent. The dynamo operating a motor (again 90 per cent efficient), bringing down the total figure to 32 per cent.

So you see by means of only four stages, you require 100 horsepower regardless of what the form is which it may assume, in order to produce at the end of the chain a horsepower rating of but 32, neglecting all friction and losses in gearing and other transmissions. Therefore, for each hour that your device runs, you will have to continually supply it with excess of power.




This perpetual motion will not work since it redelivers only 32 per cent of energy used.

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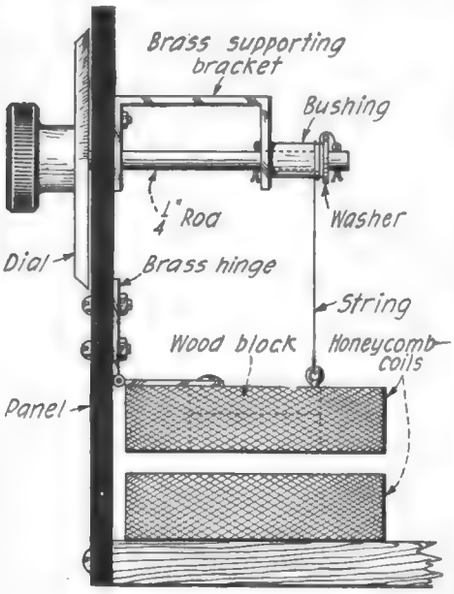
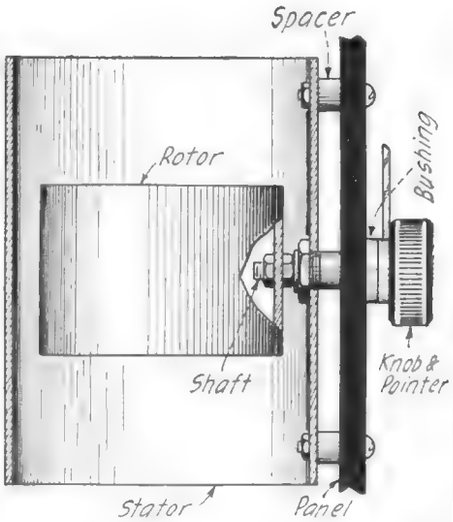
## Radio Wrinkles

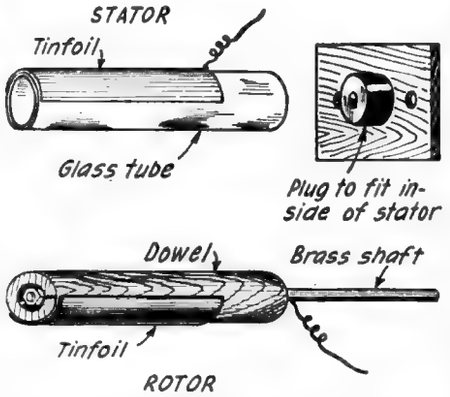
(*Continued from page 703*)




In a two-coil honey-comb tuner the coils may be mounted back of the panel and the movable coil adjusted by means of a device arranged as shown above. —Don B. Smith.




A satisfactory mounting for the rotor of a vario-coupler may be made from a standard switch arm as shown above. The contact arm should be removed and replaced by a pointer.—Leonard Lowe.




A vernier condenser may be made from a glass tube and dowel as shown above. Two pieces of tin-foil are placed thereon and mounted upon a plug. The tin-foil on the dowel is connected to the shaft. —I. D. Hunter

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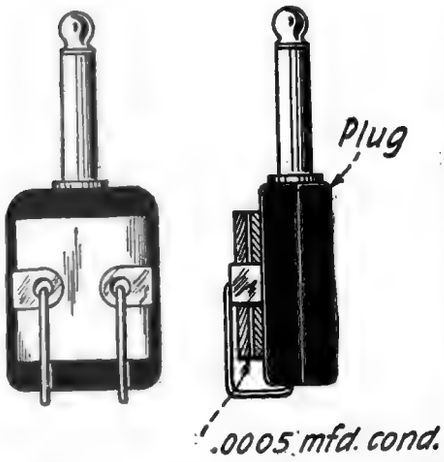
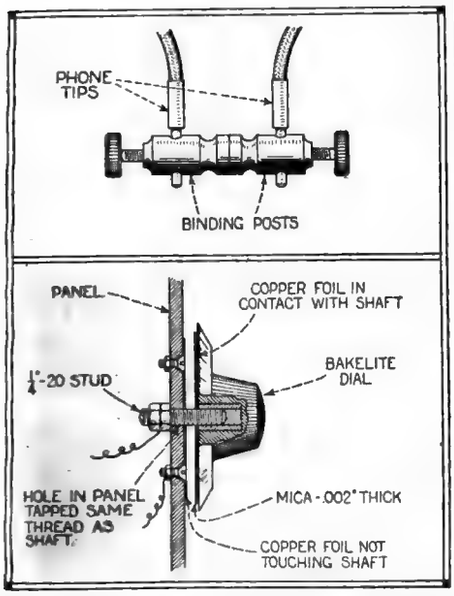
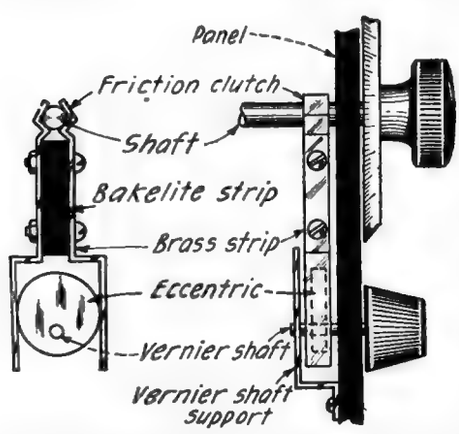



**Many times in the operation of a radio receiving set, the amateur desires to increase the capacity of a variable condenser but does not wish to add another variable. By connecting an open circuit jack in parallel with the variable condenser and mounting a fixed condenser on a plug as shown, the illustrated unit may be plugged into the circuit in parallel with the standard condenser, thereby increasing the capacity to any desired degree.**
**—J. H. Rouse.**

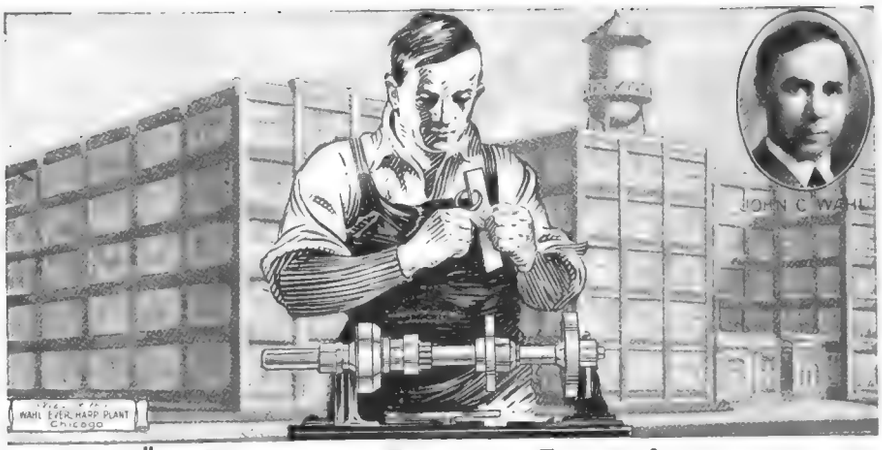



**By connecting two binding posts together with a stud, or by soldering, a very efficient phone tip connector may be made, as shown in the upper illustration.**
**—Bernard N. Brown.**

**An excellent vernier variable condenser which may be mounted directly on a panel is constructed with the use of a standard 3 or 3½ inch dial as shown above.**
**—Sydney Bond.**




**By means of a few scraps of material which are usually available, any condenser may be made into a vernier in a very workmanlike manner as shown in the above illustration. The frictional connection between the vernier and the shaft should not be too tight as it will prevent the shaft from turning freely, but it should be just tight enough to enable it to grip the shaft when the vernier is being operated.**
**—James Go.don.**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It is interesting to note that the change for the better in the life of John C. Wahl came the day he saw an advertisement that hit him straight between the eyes. As he puts it, "it told how the International Correspondence Schools could make a draftsman of a fellow without interfering with his daily work." That day, John C. Wahl enrolled and started to build for the future. His present success is proof that he builded well.

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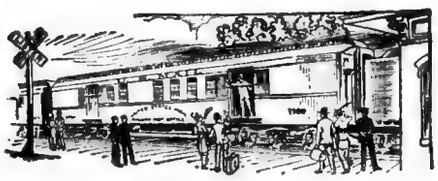

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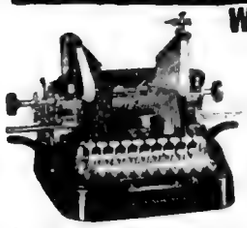

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## Dr. Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(*Continued from page 645*)

In spite of the rarefied atmosphere on the moon, which rendered all sounds almost inaudible, this conversation was carried on with ease by means of a special instrument—a miniature radiophone—the doctor had provided in the suits. Otherwise talking would have been out of the question. In fact, dead silence reigned all around them.

The pair walked on in silence for a while, and then Doctor Hackensaw suddenly stopped, for before him yawned a large opening in the moon's surface—an enormous well into whose depths he peered without being able to see the bottom.

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"Miss Pep," said he, "this must be the entrance to the habitations of the intelligent beings on the moon. And see! Here is one of their elevators, with the doors open, waiting to take passengers down! It's curious that we happened just to strike this place, but I felt a kind of leading in this direction, some invisible force pulling me here. However, let's get into the car and wait. Passengers are certain to come, sooner or later."

Pep followed the doctor into the car, and then gave a little cry.

"Look!" she cried. "The seats in the car are just like arm-chairs! There must be men here in the moon. Perhaps we're not the first people who have come to the moon."

Doctor Hackensaw was puzzled. The arm-chairs certainly seemed to indicate the presence of man. And yet, to believe that man was evolved independently on the earth and on the moon was against all the laws of probability. If men *were* here, they must have come from the earth at some previous period—perhaps the Chinese, the Hindoos or some other early civilized race had found means in bygone ages to send men to the moon. In no other way could he account for their presence. Intelligent creatures, yes—but men, no! Intelligence, like wings, could be evolved by natural selection from different organs.

Pep and the doctor seated themselves on the chairs, prepared for a long wait, but scarcely were they settled in their places when the doors closed automatically and the car, leaving the ground, started to fly down into the well.

"Hello!" cried Doctor Hackensaw in amazement. "It appears that *we* are the passengers expected. Our arrival has been seen and prepared for. Unquestionably, the Selenites are intelligent beings. It would have been a little more courteous of them to have sent somebody to bid us welcome. It may be a good sign, though, that they are not too anxious for our arrival. If they had meant to harm us they would certainly have sent an escort to meet us."

The car in which they found themselves was not provided with wings or visible apparatus of any sort, and yet it was descending rapidly into the bowels of the moon, as though endowed with intelligence. It touched neither wall, but descended, as if in flight, straight down the center of the passage. After fifteen minutes of this rapid descent, it changed its course and followed a horizontal passage. But here, also, it did not touch the ground, but flew a few feet above it.

To the doctor's surprise, although they were now several miles below the surface of the moon, the passages were all illuminated by a diffused light very much like the daylight on our earth.

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### THE FIRST MEETING WITH THE MOON'S INHABITANTS

A moment later the car stopped, the doors opened and Doctor Hackensaw and Pep felt themselves impelled, as if by some stronger will than their own, to leave the car and enter an apartment, where they found the most peculiar set of living creatures they had ever set eyes upon. Some bore a faint resemblance to our earthly mammals or to plants, but most of them bore a greater resemblance to our invertebrates or to the microscopic forms of life with which we are familiar.

To his great surprise and joy, however, the doctor found that the entire assembly was dominated by a human being—a wonderfully beautiful white woman, with a kind though majestic look on her countenance. She seemed to possess the ability to read what was going on in the minds of her two visitors. More wonderful still, she was able to answer their thoughts in such a way that they understood her perfectly, though she did not know any earthly language. The conversation, if such it may be called, translated into English, was somewhat as follows:

The Lunar queen evidently knew all about the pair. "Yes," she said, seeing their surprise, "We keep track here of all that goes on in the other planets. Consequently, we knew from the very start all about Doctor Hackensaw's plans for visiting the moon. In fact, we hesitated whether or not to let him arrive here. However, we concluded that no harm could come of your visit, so we not only allowed you to come, but even prevented your car from dashing to pieces.

"No, we are not afraid of mankind, though perhaps we are wrong in our confidence, for inferior organisms are often a great menace to higher ones. But the Lunar beings are so superior to mankind, having had several million more years for their evolution, that we fear you no more than you would fear so many fleas. We have progressed far beyond the stage reached by you on earth."

"Tell me," interrupted Pep, not in words, but in thought, "Are there men as well as women here on the moon?"

### NO SEX QUESTION ON THE MOON

"No," replied the queen. "As a matter of fact we have neither men nor women here. We abolished sex completely thousands of years ago. Sex is nothing but a cause of endless trouble and worry, as you must know, for all your habits, customs, and daily thoughts, your whole life in fact, is shaped by marriage and the relations between the sexes. We have found it much more satisfactory to create our children synthetically from the chemical elements that compose them. We are then sure of getting what we want."

"But you yourself," cried Pep, "are a woman!"

"No indeed. In truth we Selenites can scarcely be said to possess a definite shape, but we have the power of changing our appearance at will. I thought it would be pleasanter for you if I received you in the form of a woman, and I wish to be pleasant for I have a disagreeable communication to make to you."

"A disagreeable communication?"

"Yes. We Selenites do not like the idea of your visiting the moon. We believe that others of your race of savages may come over, and that nothing but trouble will arise from their visits."

"Race of savages!" cried the doctor. "Do you mean to say that you regard mankind as savages?"

The queen smiled contemptuously, and taking something apparently from the air, she handed it to the doctor. It was a copy of that morning's issue of a New York daily newspaper. Pep glanced at it eagerly and saw it was full of comments on the message she had wirelessed from the car.


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"There!" said the queen. "Look at that newspaper, one of your best dailies, yet full of accounts of murders, thefts, strikes, wars and all such things! Could any but a nation of savages tolerate things of that sort? And not only tolerate them, but gloat over them? Do you wonder that we do not wish to run the risk of being contaminated by your presence among us? Not that we are afraid of you, but we might be forced in self-defense to exterminate your race."

"Why do not some of the Selenites come to earth to teach us better?" asked Doctor Hackensaw.

"For the same reason that you do not attempt to teach your microbes civilization. The task would be hopeless. It is the work of millions of years, and countless generations of slowly progressing individuals. As for colonizing the earth, we may possibly do that some day, but it will mean the extermination of the race of man. Reassure yourselves, however. If such a thing ever happens it will not be for thousands of years to come. But now for the point in hand. You must both of you return at once to the earth."

"But how can we return?"

"I will attend to that. You will be back in less than an hour."

"But how about me?" asked Pep, on the verge of tears. "I am accused of committing a murder, and, although perfectly innocent, I have no means of proving my innocence."

"I will attend to that, too," replied the queen. "Take this box. In it you will find proofs that will convince the most skeptical."

Pep tore off the cover of the box and perceived a roll of movie film.

**LUNAR "MOVIES" OF EARTHLY HAPPENINGS.**

"Yes," explained the queen. "It is a moving picture of the murder as it really occurred. Look in this mirror on the wall and you will see the whole scene depicted."

Sure enough, a mirror appeared on the wall as if by magic, and in it the whole tragedy was enacted in natural colors. It was as Pep had surmised. One of the murdered man's victims had shot him in a fit of desperation.

"How did you get this film?" inquired the doctor, curiously.

"I had it sent from one of the nearest dead stars," replied the queen. "As you know, light travels only 186,000 miles per second. Hence the light that left the earth at the time of the murder had not yet reached the star when they received my message. They therefore made this moving picture of the murder as soon as the light rays reached them."

Doctor Hackensaw was perplexed.

"How could you send a message and receive a film faster than light can travel?"

"Because light is not the fastest thing in the universe," replied the queen. Gravitation travels much faster than light. To you on earth, gravitation seems to act instantaneously. As a matter of fact it is really slow, but it travels from the earth to Sirius in less than one second, a speed immensely superior to that of light. I sent a wireless message by gravitation and received the film here almost instantaneously by the same means. . . Here is an older film which shows the earth as it appeared before the advent of man."

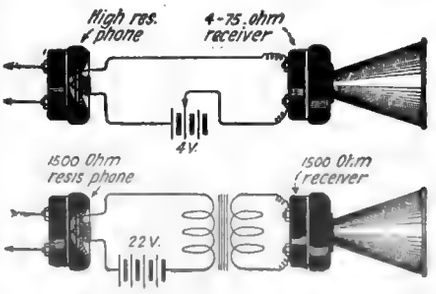
As she said the words there appeared on the mirror a prehistoric landscape with the brontosaurus and other paleolithic monsters browsing in the primeval forests, while the ichthyosaurus and plesiosaurus sported in the waters and the pterodactyl flew overhead.

# How to Hook-Up A Transmitter Button to Make an Efficient Loud Talker

A Transmitter button with a few dry cells and a telephone receiver will make a remarkably simple and efficient loud talker. A Microphonic amplifier of this type is just the thing for use with a radio set. The weak music and signals may be amplified many times their original value. It is possible to entertain a large audience with a simple radio equipment if a transmitter button is used in the circuit as explained in diagram A.

The cost is extremely low and the results are comparable with those produced by highest grade of expensive loud talkers.

As may be seen in the diagram, two dry cells or a small storage battery are connected in series with the transmitter button and a 4 to 75 ohm telephone receiver. The transmitter button is secured to the diaphragm of the telephone in the radio receiving set. To accomplish this properly, scrape off the enamel (if diaphragm is enameled) on the face of the diaphragm and solder the small hexagon nut supplied with the button to the exact center. Care should be taken that the thin diaphragm is not bent or otherwise




harmed. The transmitter button is then screwed into place. Connections, as shown in the diagram, are made with flexible wire. A horn may be placed over the low resistance receiver if desired. When the radio set is properly tuned and signals are being received, the transmitter button is operated by the vibration of the diaphragm of the receiver. As the receiver diaphragm vibrates, the mica diaphragm on the transmitter button also vibrates. The carbon grains are compressed at varying pressure; the current flowing through the local battery circuit is thus varied and results in an amplification of the sounds in the low resistance telephone loud-talker.

Diagram B, which includes a step-up transformer, is to be used with loud talking receivers of high resistance. The primary of the transformers should have a resistance of about 75 ohms. An ordinary telephone induction coil will serve as the transformer in this circuit.

You can get the above-described transmitter button FREE in subscribing to "Practical Electrics Magazine" at $2.00 per year (12 months). Send your subscriptions today.

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—Adv.

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Doctor Hackensaw gazed at the pictures with interest, and then asked: "How about the planetary machine that we saw on our way here? What is its object?"

"Its function is to utilize the sun's heat," explained the queen. "Half of the moon is always brightly illuminated by the sun. The heat thus received is stored up automatically in the body of the moon. From here it works the planetary machine which sends wireless waves wherever we happen to need power. The radiator-like instrument serves as the regulator."

"Would you allow me to have a description of the machine so I can construct one like it?"

"No indeed. Your knowledge is insufficient and you would be sure to kill yourself in the attempt to control these forces. Besides, too much knowledge would make you miserable. The world has no use for a man who is too far ahead of his time. But enough of this. You can have dinner here, and then you must go."

"What do you eat?" inquired the doctor, curiously.

### LUNAR BEINGS DO NOT EAT

"We Selenites do not eat at all. We breathe in the carbon, oxygen and hydrogen that are necessary for life. We see to it that our atmosphere contains these elements in the proper proportions."

"But carbon is a solid," exclaimed Pep in surprise. "You cannot breathe charcoal?"

"Carbon is a gas in the form of carbon dioxide, and we are able to utilize it in our bodies in this form, decomposing it into its carbon and oxygen. But here is your meal," she continued, as a table appeared loaded with all sorts of delicacies.

Pep, who had been expecting a meal of carbon, oxygen and hydrogen, gave a squeal of delight when she saw the wonderful meal that was served. There were soups, meats, vegetables, fruits, pastry and sweets of the kind she liked the best.

The pair ate heartily, but some narcotic must have been in the food, for scarcely was the last mouthful eaten when they both felt themselves overpowered by a heavy sleep.

### BACK TO MOTHER EARTH

When they awoke they found themselves back in the couches in the car. Doctor Hackensaw threw open the door of the vehicle and gave a cry. And well he might cry out! Here he was back again on earth, in his own New Jersey estate.

The queen had kept her word. The return journey to the earth had lasted less than one hour!

THE END

## FINISHING TOUCHES FOR HOME-MADE RADIO SETS

After completing the set give all of its wood work a coat of stain followed by two coats of good varnish. If the panel is made of bakelite or some similar substance, if it is stained or varnished, a high polish can be given it by rubbing briskly with a cloth dampened with olive oil.

To copper coat iron. Clean the iron with a mixture of fifty parts of hydrochloric acid and one part nitric acid. Next immerse the iron in a solution of one part of copper sulphate in ten parts of water. This gives only a thin coating, little more than a color. Battery plating is much better and is very simple for copper deposition.

Bronzing iron and brass. Mix a solution of one ounce of hyposulphite of soda and two ounces of acetate of lead in two pints of water. Bronzing is done by dipping the articles in the solution until well bronzed. Iron when so treated shows a blue tint and brass becomes either a redish or bluish color when immersed in the solution.

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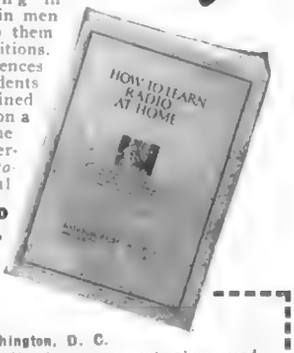


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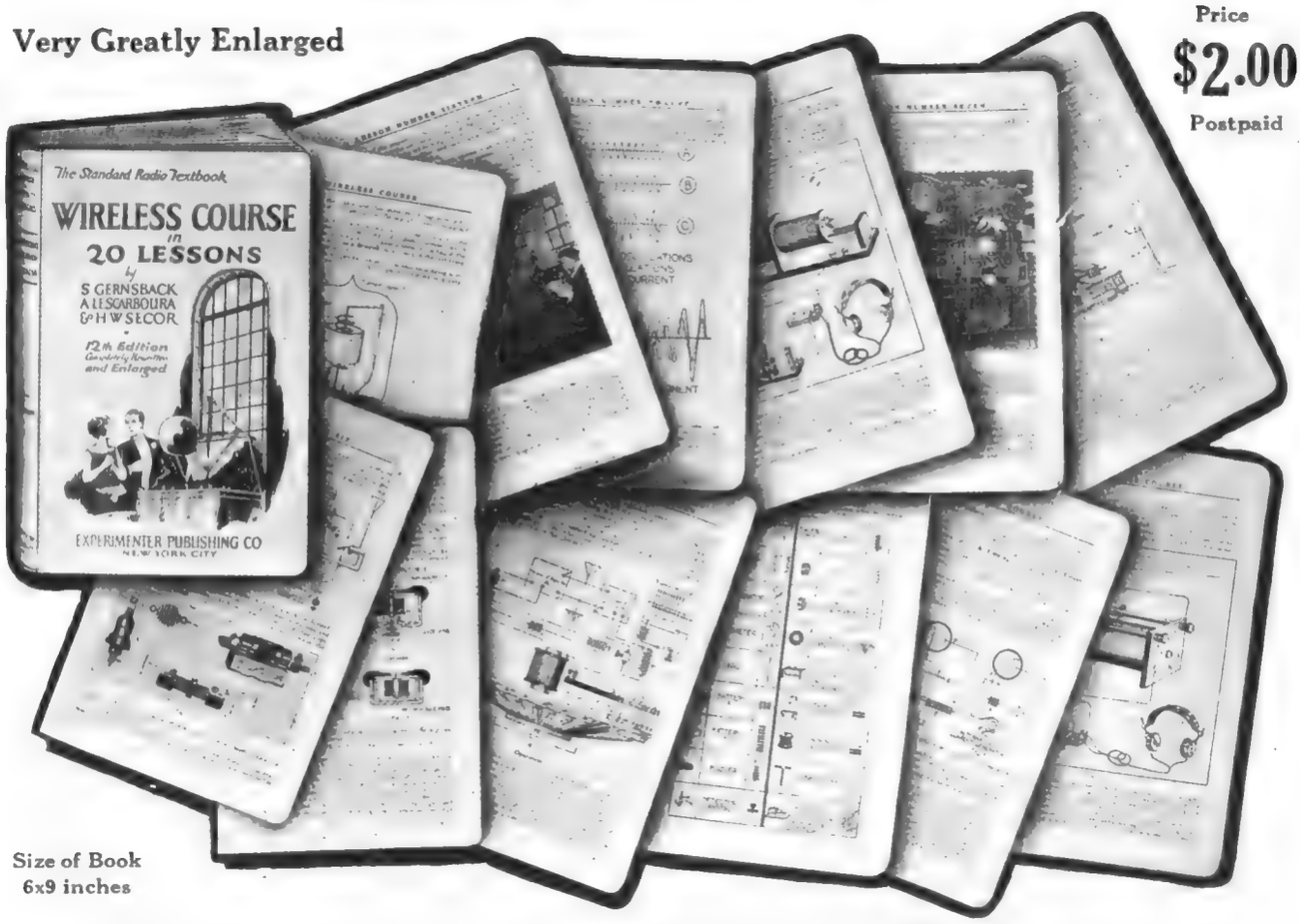


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## Around the Universe

BY RAY CUMMINGS

(*Continued from page 643*)

fraction of a second away at this velocity. A collision with one was a blind chance which they could not avoid taking.

Twenty-four hours after passing Alpha Centauri the voyagers found themselves distant from the Earth some 15½ light-years. Sir Isaac left his mathematics for an hour that afternoon to point out to his friends places of interest in the Heavens.

The firmanent now shone with dazzling brilliancy, though the faint stars of the Milky Way still seemed as far away as ever. The sun of the Solar System—its planets quite invisible—had dwindled to one of the faintest of all the stars in that region. Alpha Centauri, visually quite near the sun, was infinitely brighter, but still it was surpassed by many of its fellows.

### TUBBY GETS A FEW COMPARISONS

Sir Isaac, passing from one window to another, pointed out the red stars—Antares, most deeply colored of all—Betelgeuse, Aldebaran and Arcturus. Tubby wondered if any of these stars were as large as the Sun, or whether it was only on account of their closeness they looked so much brighter. Sir Isaac laughed with genuine amusement.

"They are somewhat larger," he said ironically. "Take Betelgeuse, for instance. There's our Sun—there's Betelgeuse. Our Sun is about 15½ light-years from here—Betelgeuse is about 150 light-years!"

"He—he must be lots bigger, then," Tubby concluded after a moment of amazement.

"He is," said Sir Isaac. "Professor Albert Michelson measured the diameter of Betelgeuse in the autumn of 1920. His figures show that star to be equal in size to 27,000,000 Suns like ours!"

Tubby was staggered. Sir Isaac went on calmly.

"The diameter of Betelgeuse is 260,000,000 miles. Let me show you how really enormous that is. You remember our trip from the Earth to Venus, and to Mercury? Well, if Betelgeuse were a hollow globe and you put our Sun suspended in its center, Mercury, Venus and the Earth would all have plenty of room to traverse their orbits inside it! Even the orbit of Mars would only be a short distance outside!"

Neither Tubby nor Ameena could think of anything to say.

"Professor Michelson found all that out by what he calls the 'Interference Method.' I won't bother you by explaining it . . ." Sir Isaac raised his hand despairingly. "Of course Michelson deserves a lot of credit. I never had occasion to work on just that particular problem, or I would, of course, have been able to—"

"Show us somethin' else," Tubby interposed.

Sir Isaac pointed out several binaries that now were visually separated. It was all a most wonderful sight; the multiple stars—"clusters"—and the curious spiral nebulae, the still faint, far-off Milky Way. It was indeed a stupendous, awe-inspiring sight, though Tubby and Ameena were now sufficiently used to it, to be comparatively unimpressed.

For nearly a week the vehicle, with steady acceleration, dropped into Space, while Sir Isaac worked almost incessantly at his computations and Tubby and Ameena engrossed themselves in each other's companionship.

They entered the Milky Way on the seventh day after passing Alpha Centauri. Though their actual entrance into the Galactic Plane was unmarked by any visual phenomena—the firmament blazed with stars

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# What's in a Name?

TIMES have changed since the Bard of Avon put his famous query, "What's in a name?" In Shakespeare's day the most successful merchant was the biggest skinflint. His name meant nothing. You entered his shop with your eyes open and your fingers crossed. You haggled and you bargained. And if you were especially astute, perhaps you retained your eye teeth.

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as usual—a different set of stars were now brightest, but to the non-technical observer there was no marked change.

During this week an apparent star motion had gradually increased, until now, looking down through the lower windows, the stars could be seen opening up as the vehicle dropped into them—separating themselves, passing upward, across the side windows, and closing together again overhead.

"How fast we goin' now, perfessor?" Tubby asked once.

It was at supper time. Sir Isaac hastily masticated a huge mouthful of cheese sandwich and washed it down with a swallow of coffee, before replying.

"I cannot tell you in miles," he answered. "In light-years I estimated it this morning to be about 1/120 a second. That is, ½ light-year a minute, or about 720 a day. We are now about 3,500 light-years from the Earth."

Tubby had by this time made up his mind never to be surprised again at anything.

"That's an awful lot faster than we used to go, ain't it?" he remarked. "Around Mercury or Venus, f'r instance."

Sir Isaac's smile was condescending.

**TUBBY GETS DOPE ON REAL SPEED**

"The diameter of the entire Solar System, from Neptune's orbit, across the Sun, and out again to Neptune's orbit on the other side is a mean distance of 5,593,056,000 miles. We are traveling that distance now just about once every second!"

Probably no other statement of Sir Isaac's was so amazing. And, as Tubby and the girl pondered it, the immensity of this Space through which, day after day, night after night, they were plunging at this almost inconceivable rate, was made clear to them.

**Sir Isaac added laughingly:**

"The Solar System isn't very large. Why, that star Betelgeuse could hardly turn around in it. A mere 5,500,000,000 miles,—it's only a few times the diameter of that one star."

How Sir Isaac ever avoided the stars of the Milky Way, even with the gigantic distances separating them, he never understood. All that night, his still elusive calculation neglected, he sat at the floor window in the instrument room. From time to time he leaped to the keyboard to alter their course. It was a nerve-wracking, horrible night. But in the morning, when Tubby, and a little later, Ameena appeared, the Milky Way lay glistening above them. Below, only a few stars showed; beyond that, darkness—blank, unfathomable.

Sir Isaac greeted his friends with a wan smile; he was on the verge of physical exhaustion, but his spirit remained undaunted.

"We are beyond the stars," he said. "It is as I always thought. Even from Earth I have telescopically observed a perceptible thinning out of the Celestial bodies. We have reached the limits of our Celestial Universe on this side. We have now below us only empty Space—unless we encounter another Universe."

Sir Isaac quite evidently had his own theories as to what lay beneath them in that void of darkness. But he smilingly resisted all Tubby's efforts to make him talk about it.

Finally in desperation, Tubby exclaimed: "We ain't got no business goin' much farther. The opposition of Mars comes off in forty-two days from 6 P.M. tonight—an' we're gettin' a fair distance away from the excitement."

Sir Isaac smiled confidently. "We shall return without a stop—quite in time, even at our present speed. That isn't worrying me. It's—"

"Your calculations?" supplied Ameena. Your great plan of which you will tell us nothing? How are they progressing, Sir Isaac?"

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His face clouded. "I have been so busy," he said somewhat anxiously. "But I'm making progress. Now that we are beyond the stars, I will have more freedom—will redouble my efforts."

Poor Sir Isaac, for all his eagerness to work, was forced to retire immediately after breakfast for a few hours of much needed rest. They awakened him for luncheon—which he gobbled in haste—retreating at once to the instrument room, where by the light of the table electrolier, he became instantly immersed in his interminable figures.

Thus, in similar fashion, while the vehicle plunged onward through Space at a velocity sufficient to take it across the 5,593,056,000 mile diameter of the Solar System in very much less than one second, fifteen more days and nights of interminable voyaging went by!

### EXPLORING OUTER SPACE

The Universe of which our Solar System is so minute a portion, had long since faded into invisibility. Others had been distantly sighted on both sides, and passed overnight—reduced by comparison into mere nebular regions, though each may have been as large, or larger than our own Universe.

On the fifteenth day, skirting alongside a smaller Universe—possibly no more than a thousand light-years in diameter, Sir Isaac announced that they were approaching the end of their outward voyage.

The vehicle was still dropping into that vast void of silence and darkness with a velocity now quite beyond calculation. It was a decreasing velocity, now, however, for, sometime since, Sir Isaac had begun to retard it.

Overhead, the last starry firmament was visible, though every hour with perceptibly lessening brilliance. Tubby and Ameena sat together in the observatory, watching the receding stars, and wondering how, among all these Universes, Sir Isaac would ever set his course going back, in order to reach that particular one of the Solar Systems to which they belonged.

The temperature of the vehicle was now, curiously enough, very comfortably warm—so warm indeed, that Tubby wore his white clothes and Ameena that dainty costume in which he had first seen her on Venus. This paradox of temperature—for here in outer Space it should have been insufferably cold—Sir Isaac had explained to them the evening before. Their velocity was so great, he said, that even the minute, widely separated atoms of the ether, pounding against the vehicle's base, were heating it—just as it had been heated before when passing through the atmospheres of the several planets upon which they had landed.

Sir Isaac, alone in the instrument room, worked over his figures incessantly, feverishly, all that afternoon. It was nearly five o'clock when, with a cry of triumph, he dropped his pencil and staggered to his feet.

"I've solved it! Tubby, Ameena, my friends, at last the problem is completed. We shall save our Earth now—nothing can prevent us!"

With head reeling, he groped his way out into the dim hallway and up the stairs, looking for his companions. In the starlight of the observatory he found them—Tubby lying prone with his head in Ameena's lap, she stroking his hair gently, singing softly a tender love-song of Venus.

"I've solved it!" Sir Isaac cried. "We cannot fail now to save the Earth! My calculation is completed at last, down to the smallest decimal."

Tubby turned his head slightly; Ameena's song died away.

"Oh, is that you, perfessor? Come on in an' congratulate us. Ameena an' me just got engaged!"

(*Continued on page* 719)


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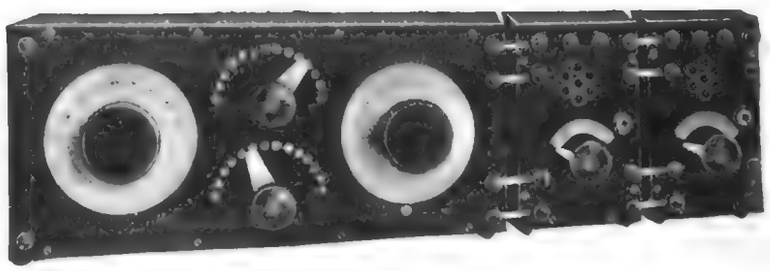

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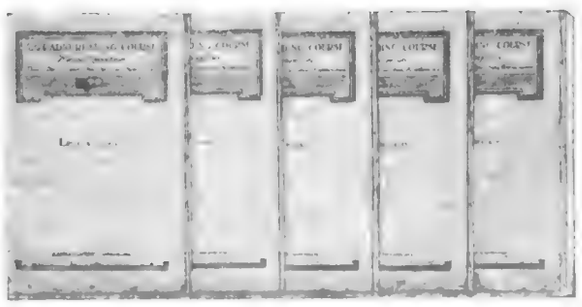

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## Around The Universe

(*Continued from page 717*)

### CHAPTER X.

### IN WHICH THE VOYAGERS REACH THE INNER SURFACE AND SPEEDILY DEPART THEREFROM AFTER A MOST AMAZING EXPERIENCE.

The silent, lonely, little vehicle plunging through the darkness of Space, a world to itself, now rang with the gay laughter of its three inhabitants. Sir Isaac had successfully completed his complex calculation, using therein every intricate device known to higher mathematics, with a verified result correct to seventeen decimals. Tubby and Ameena were engaged to be married. What stupendous events to have occur simultaneously. No wonder the little Celestial wanderer was the scene of rejoicing.

It was an evening of the gayest festivity. Sir Isaac, proud and happy as a boy, kissed the radiant Ameena, fending off Tubby who tried to stop him. Then the girl went into the kitchen and prepared the evening meal. And such a dinner it was. For two hours they sat over it, laughing and discussing their plans.

"We must hasten now," Sir Isaac said in a moment of comparative quiet. "Nothing remains but for me to show you the edge of Space, which I want very much to do. Then we must hurry back and put my plan for the downfall of Mars and his allies into operation. I fear nothing now. We cannot fail."

"You can't get back to quick for us," Tubby declared. "This here outer Space ain't no place to go lookin' for a minister in. Where we goin' to get married, Ameena? The Earth or Venus?"

The girl had not yet made her choice; and the question was left open.

The penny-ante poker game in the instrument room—a game at which Ameena had now become extremely proficient—lasted well into the night. When it was over Sir Isaac made a brief calculation and concluded that the "Edge of Space"—as, with a slight smile he still insisted on calling it—was still considerably below them. The vehicle therefore, needed no attention.

After this pleasant discovery, Ameena lingeringly parted from Tubby and retired to the upper floor. The two men made up their beds in the instrument room. Within fifteen minutes all three were fast asleep.

Evidently nothing unusual occurred during the night, for when the three voyagers awoke about ten o'clock next morning they found themselves still silently dropping into the abyss of blackness. Overhead the stars of that last Universe were still visible, though now extremely faint.

#### SOCIAL LIFE BEGINS

During a lazy breakfast the three friends fell to talking personalities.

"You got a lot of names, ain't you perfessor?" Tubby said.

"Quite a good many," responded Sir Isaac pleasantly. He was obviously pleased at the question. "I am usually known merely as Sir Isaac Swift DeFoe Wells-Verne—but I have other names—Stockton, for instance."

"What's the 'Isaac' for?" Tubby asked. "I ain't never seen that on your books."

Sir Isaac frowned. "Well, to tell you the truth, my friends, I am just a little ashamed of that. Even in my early infancy my marked scientific bent was apparent, and my grandfather insisted on my being named


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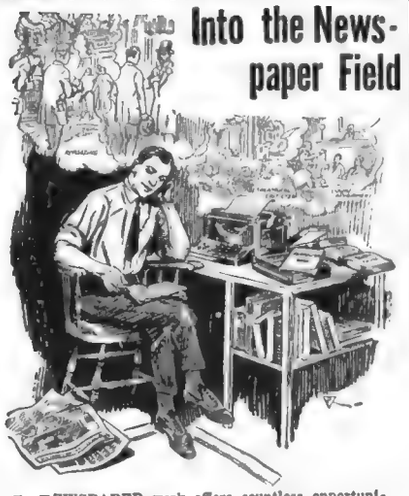

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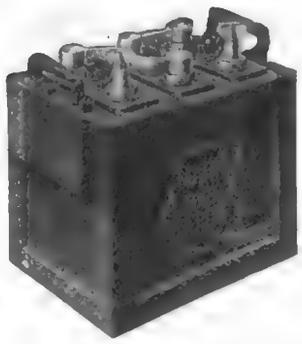

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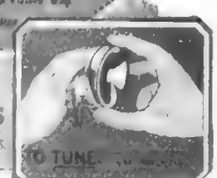


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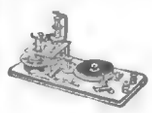

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Isaac. He was a great admirer of Isaac Newton, you see. Of course Newton was, in a way, a brilliant man. I would have preferred Jules, or Herbert George however. I often use both those names. I think Herbert George is rather natty, don't you?"

Ameena agreed that it was.

Sir Isaac might have pursued this interesting topic indefinitely, but Tubby cut him short.

"Won't you please tell us about this here Edge of Space we're headed for?"

Sir Isaac, in view of their imminent arrival at the Edge of Space, evidently considered that the proper dramatic moment had come to tell them about it.

"I'm sorry you are not familiar with my scientific narrative, the 'Golden Atom,'" he began somewhat pompously. "However, that is immaterial . . . In it I explained that every atom of the Universe is really a world in itself. Its interior is a void of ether, an infinitesimal core of Space, surrounded by a shell of matter. That is an atom. I do not mean the old-fashioned word atom, but the inner nucleus which the professional scientists of Earth have just managed to discover. Do you follow me?"

"Sure," declared Tubby. "An atom is like a cocoanut, only with ether where the milk ought to be."

Sir Isaac beamed; Ameena regarded Tubby with admiration.

### SIR ISAAC'S THEORY UNFOLDS

"Exactly," agreed Sir Isaac. "There are electrons, of course, which Sir Ernest Rutherford most doggedly insists are particles of disembodied electricity—negative, you know—spontaneously liberated from the atoms. However, in this Golden Atom which I described, there revolved, in its central void of ether, an infinite number of minute worlds, stars, planets, comets; a complete little Universe of its own. Do you still follow me?"

His two auditors nodded somewhat dubiously.

"What's this got to do with the Edge of Space?" Tubby demanded.

"I'm coming to that. You must understand now, that just as all distances and all motions are relative one to the other, so also is size. I have brought to your imagination the golden atom containing a minute Universe in its central void of Space. That to our minds, is almost infinite smallness."

Sir Isaac hesitated impressively.

"Now, my friends, remember, size is only relative. Conceive now another atom, an almost infinitely large atom. Within this gigantic atom, revolving in its central void of ether, place a Celestial Universe—the Celestial Universe in which you and I live, the stars and planets among which we have been voyaging for many days past."

"Yes," said Tubby faintly. "An' then—"

"Then you will realize that we are soon to reach the limits of this atomic void. We shall land upon the inner, concave surface of the atom which contains us!"

Sir Isaac's smile was triumphant.

"Is that not wholly logical that we shall land upon this inner surface shortly? But we will not stay there, or proceed further. We must return at once to our own tiny little planet. So much for facts. If you wish to imagine beyond that, I shall say that were we able enormously to increase our bodily size, we might pass through the shell of our Atom, which possibly is as thick through as it is across its central void of Space. Then we should emerge on the convex outer surface. By still further increasing our bodily dimensions, we would outgrow this Atom and find ourselves in another world, an infinitely larger, inconceivably large world, of which this Atom of ours may quite well be an atom of somebody's wedding ring, or the atom of a column in a King's castle, or the minute fragment of a grain of sand in a vast desert.

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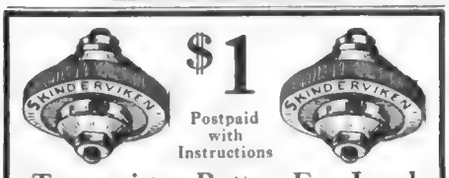


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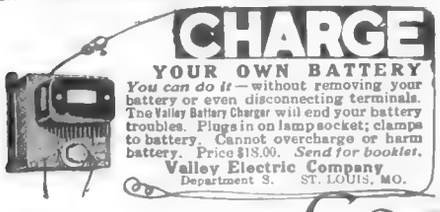
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You asked me about absolute motion. Suppose our atom *is* in a grain of sand of some vast desert and is now being blown in a storm—or that—"

"Never mind any more," Tubby cried. "We got the idea, ain't we Ameena?"

"It is very wonderful," the girl declared slowly. "But a little difficult to follow, just at first."

"You'll get used to it," said Sir Isaac. "Just keep on thinking about it a while. It's my own theory. I'm going to tell Sir Ernest about it because *my* atom is really that inner nucleus, that portion, around which his electrons revolve. So you see this theory of mine will help him out a lot . . . Ameena, you do make very good coffee. Can I have another cup?"

When, after breakfast, they gazed down through the floor window, a very faint luminous glow seemed growing in the blackness far below them. Sir Isaac regarded it intently a moment, then with a cry of satisfaction hastened to the keyboard.

"That is light diffused throughout the atmosphere of the Inner Surface," he said, as he altered the positions of several of the keys.

"I am checking our velocity very rapidly now," he added as he straightened up. "We will arrive at our destination this evening."

His prediction was correct. All that afternoon the luminous glow beneath them grew in intensity. By supper time it gleamed like a pale phosphorescence, spreading out in all directions to the visual limits of the floor window. Shortly after supper they entered the atmosphere of the Inner Surface at an altitude which Sir Isaac calculated to be several hundred thousand miles.

It was nearly nine o'clock when Tubby, peering downward, saw what might have been the broad plateau of a mountain-top coming up out of the yellowish, luminous haze. It was a flat surface extending out of sight in three directions. But its fourth side, almost directly beneath them, ended in a sharp line with a dimly yellow abyss beside it.

"Look at the cliff," Tubby called to Sir Isaac. "You better slow up some more an' figure out where we're goin' to land."

They were then some ten thousand feet above the top of this "cliff," as Tubby called it. Sir Isaac, after a careful inspection of it which was difficult in the very dim, hazy yellow light, finally decided to descend very slowly close beside its perpendicular face and thus reach the lower level of land adjacent.

They made the descent in the dim starlight in an increasing yellow glare from below a thousand feet away from the face of the precipice. The wall of rock extended in a direct line as far as they could see as straight as though it were hewn by a rule.

### AT THE OUTER SURFACE

It was a descent of some fifteen miles. Tiny points of light now showed beneath them. Through the side window of the instrument room, the dim face of the huge rocky wall slid swiftly upward, as though the vehicle were a silently dropping elevator car. Occasionally, rectangular openings in the rock wall went up past the window, openings five hundred feet long, from which a lurid glare of yellow-red light blazed with blinding force out into the night.

"Say," whispered Tubby, awe-struck. "What sort of a place is this?"

A brilliant ball of fire, seeming hardly more than a hundred feet away, came vertically up past the side window, a ball of blazing flames ten times the size of the vehicle itself. The heat from it was tremendous. From the lower window an even brighter though diffused light was streaming in; and a deafening, roaring noise filled the room.

(*Continued on page 723*)

Earle E. Leiderman as he is to-day.

## If You Were Dying To-night

and I offered you something that would give you ten years more to live, would you take it? You'd grab it. Well fellows, I've got it, but don't wait till you're dying or it won't do you a bit of good. It will then be too late. Right now is the time. To-morrow or any day, some disease will get you and if you have not equipped yourself to fight it off, you're gone. I don't claim to cure disease. I am not a medical doctor, but I'll put you in such condition that the doctor will starve to death waiting for you to take sick. Can you imagine a mosquito trying to bite a brick wall? A fine chance.

### A Re-built Man

I like to get the weak ones. I delight in getting hold of a man who has been turned down as hopeless by others. It's easy enough to finish a task that's more than half done. But give me the weak, sickly chap and watch him grow stronger. That's what I like. It's fun to me because I know I can do it and I like to give the other fellow the laugh. I don't just give you a veneer of muscle that looks good to others. I work on you both inside and out. I not only put big, massive arms and legs on you, but I build up those inner muscles that surround your vital organs. The kind that give you real pep and energy, the kind that fire you with ambition and the courage to tackle anything set before you.

### All I Ask Is Ninety Days

Who says it takes years to get in shape? Show me the man who makes any such claims and I'll make him eat his words. I'll put one full inch on your arm in just 30 days. Yes, and two full inches on your chest in the same length of time. Meanwhile, I'm putting life and pep into your old back-bone. And from then on, just watch 'em grow. At the end of thirty days you won't know yourself. Your whole body will take on an entirely different appearance. But you've only started. Now comes the real works. I've only built my foundation. I want just 60 days more (90 in all) and you'll make those friends of yours who think they're strong look like something the cat dragged in.

### A Real Man

When I'm through with you' you're a real man. The kind that can prove it. You will be able to do things that you had thought impossible. And the beauty of it is you keep on going. Your deep, full chest breathes in rich pure air, stimulating your blood and making you just bubble over with vim and vitality. Your huge square shoulders and your massive muscular arms have that craving for the exercise of a regular he man. You have the flash to your eye and the pep to your step that will make you admired and sought after in both the business and social world.

This is no idle prattle, fellows. If you doubt me, make me prove it. Go ahead. I like it. I have already done this for thousands of others and my records are unchallenged. What I have done for them, I will do for you. Come then, for time flies and every day counts. Let this very day be the beginning of new life to you.

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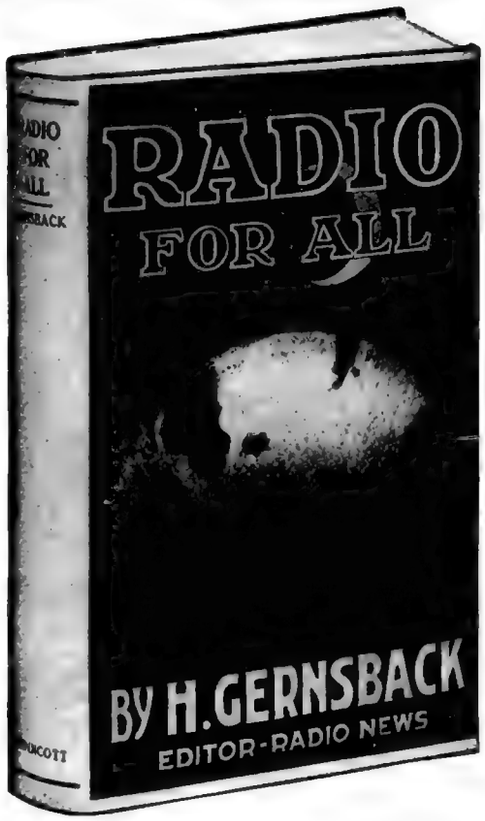


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## Around The Universe

(*Continued from page 721*)

It all happened within the space of a few seconds. Sir Isaac, who had been hovering anxiously between the windows and the keyboard, became suddenly confused. He started toward the table, then changed his mind and leaped to the side window, half falling over Ameena, who was in his path.

"Look!" shouted Tubby, above the roar. "Hey, look out, perfessor! Let's get up out of here!"

An enormous, swiftly moving black surface, completely obstructing the side window for an instant, went past close outside. Sir Isaac leaped back to the table just as the vehicle struck something soft and yielding—a glancing, sidewise blow. Tubby and Ameena were hurled to the floor. Sir Isaac, clinging desperately to the table, fumbled for the keyboard, and altered several of the keys. There was a gigantic swishing noise; the room trembled—tilted sidewise. Then silence.

Tubby raised his aching head. "Where's Ameena? Ameena! You ain't hurt?"

Her faint voice reassured him. He raised himself to a sitting position. "Oh, perfessor—you hurt? What happened? Where are we?"

They were none of them more than badly shaken up. The room was level again, vibrationless, soundless. Through the floor window shone the faint stars; out of the side window, high above, the yellow glare of the Inner Surface was fading. The vehicle had turned over, and was again dropping out into Space!

Tubby lifted Ameena to a chair and kissed her reassuringly. "'Sall right. We ain't hurt none. What happened, perfessor? What *was* all that?"

Sir Isaac did not know. For an hour they compared notes on what they had seen. It had all happened so quickly; it was so confusing, so unexpected. Their view through the little windows at near objects was so limited they found that each of them had seen things differently.

"Well, anyhow," Tubby declared with a shrug, "we landed on that there Inner Surface, an' we got away again without gettin' smashed up. Now let's get home an' fix this Mars business. We only got twenty-six days left."

With the entire repellent force of the Inner Surface above it, and the attraction of several of the celestial universes at its base, the vehicle rapidly gained velocity. It was nearly midnight when Sir Isaac, coming out of a profound meditation, suddenly exclaimed.

"I know what happened to us on the Inner Surface! Fancy that! How I could have been so stupid?"

"What?" demanded Tubby.

Ameena, who just at that moment was preparing to retire to bed, stood poised with a bottle of liniment in her hand.

Sir Isaac said excitedly:

"The inhabitants of the Inner Surface, relative to us, must be gigantic in size. How silly of me not to have realized that!"

"Well?"

"Well," Sir Isaac continued, "that was a gigantic building alongside of which we went down—a building fifteen or twenty miles high! Those huge, yellow rectangles were its lighted windows! That ball of fire was a street light! We descended directly into a city street, *and collided, probably, with the coat-sleeve of a pedestrian!*"

(*To Be Continued.*)

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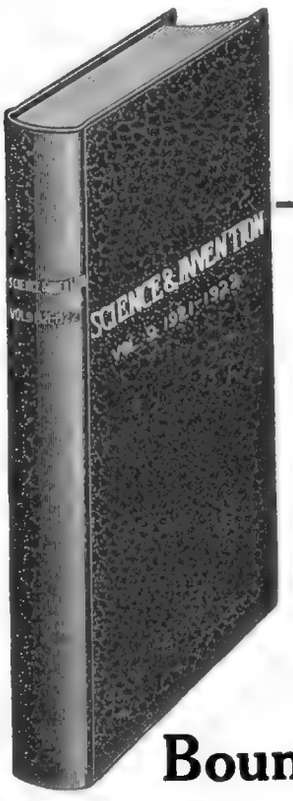


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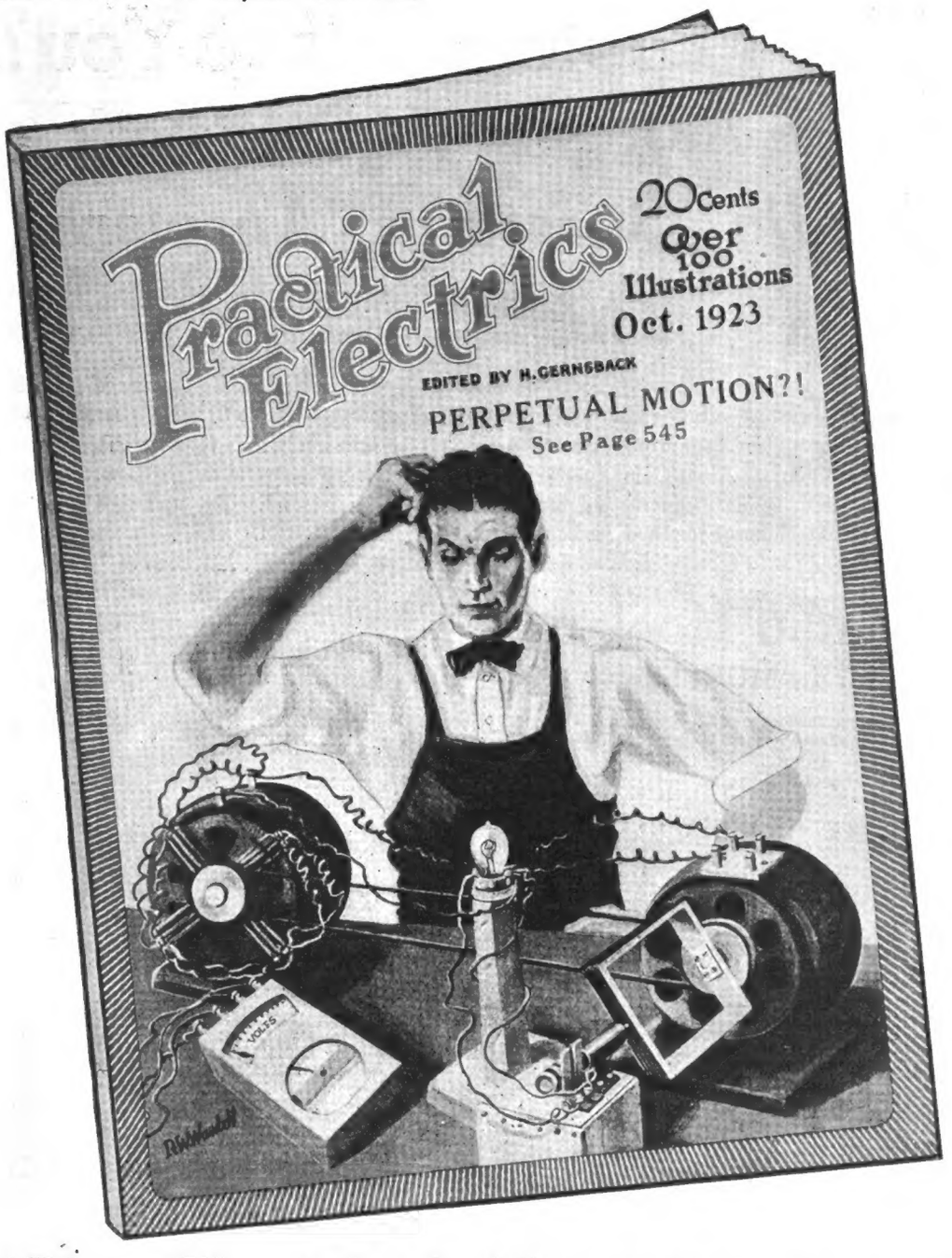


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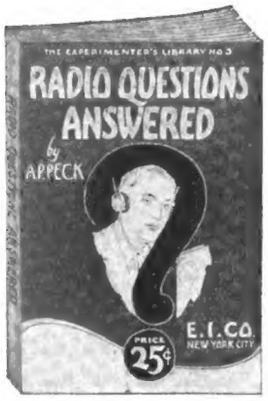


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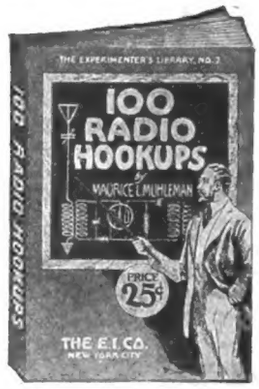


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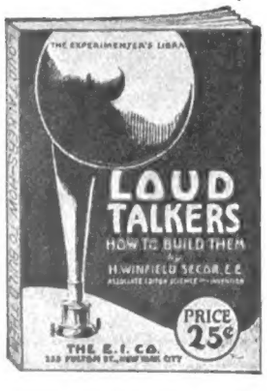


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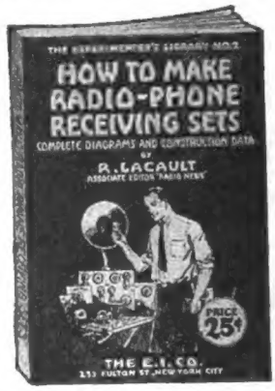


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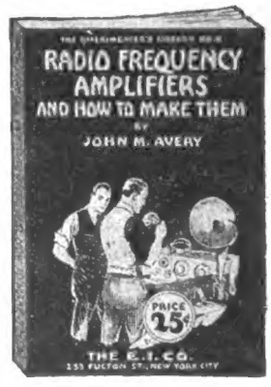


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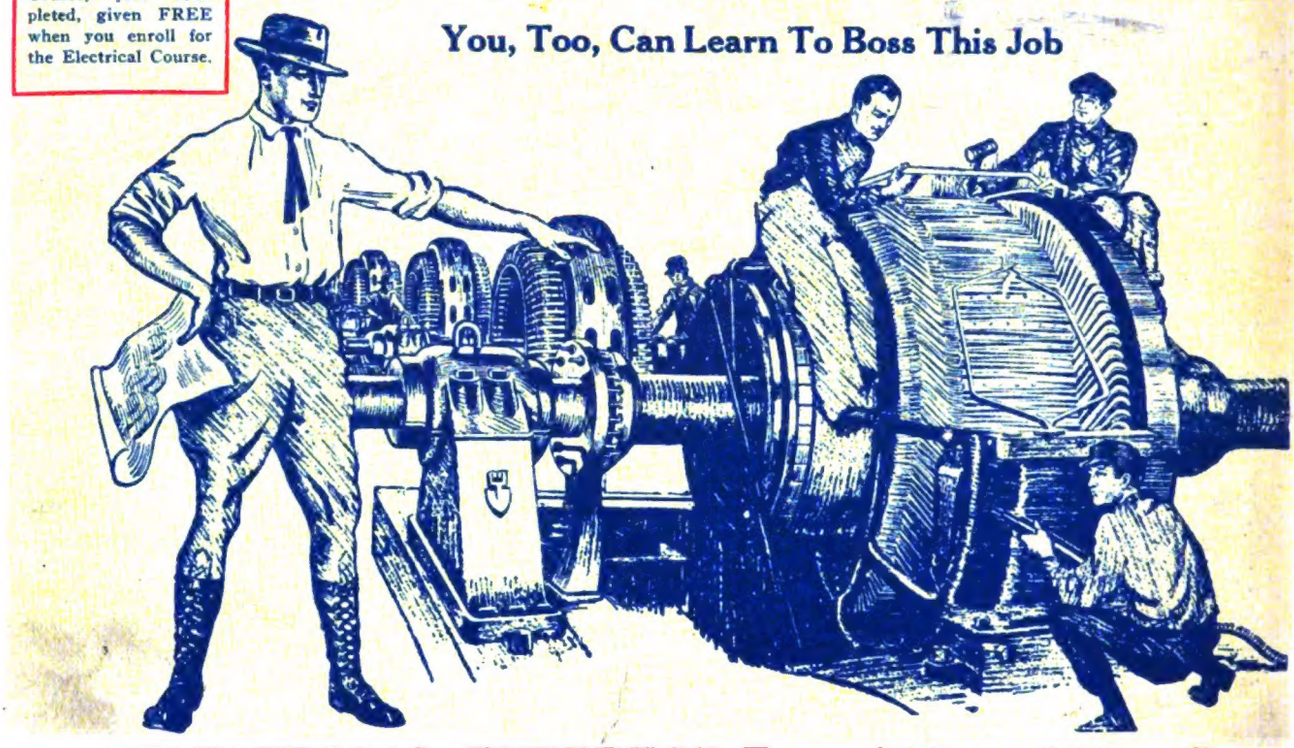

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